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VOL. CXXXVI.—No. 3527] LONDON: FRIDAY EVENING, AUGUST 3, 1923 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, REQUIRES:

1. STEEL BOILER TUBES.
2. COPPER FIRE-BOX PLATES.
3. AXLE-BOXES, CAST STEEL or MALLEABLE CAST IRON.

Tenders due on the 24th August, 1923, for Nos. 1 and 3 and on the 21st August, 1923, for No. 2. Tender forms obtainable from above. 3192

War Department. TENDERS are REQUIRED for the PURCHASE and REMOVAL of the undermentioned

SURPLUS MACHINERY AND BUILDINGS, &c., as under:—

SUPPLY RESERVE STORE, DEPTFORD.

ONE SET HAY BALING PLANT, complete with hay boxes, steel piping, &c.
ONE HORIZONTAL PRESS, belt and gear driven, complete.
FOUR BAND SAWS, belt driven, with pulleys, countershaft; size of table, 3ft. 6in. by 4ft. (one band saw without countershaft).
THREE STEAM ENGINES, Vertical, single and double cylinder, with fly-wheels, &c.
Makers, Marshall and Sons and Craven Bros.

MEDICAL STORES, WOOLWICH.

EIGHT NON-SECTIONAL STEEL-FRAMED BUILDINGS, corrugated steel walls and roof, large double entrance doors, continuous skylight roofs; size, 150ft. by 30ft. by 14ft. to eaves.

SEVERAL ARMY HUTS, VARIOUS SIZES.

Forms of Tender, conditions of contract, permits to view, and all other information can be obtained from the undersigned up to 8th August, 1923.

C. T. MORRIS EVANS, Lieut., S.R.E.S., for C.R.E., Woolwich District.

R.E. Office, New-road, Woolwich, S.E. 18, 23rd July, 1923. 3183

G. R.

LAKEDOWN AERODROME.

Tenders are Invited for the PURCHASE and REMOVAL of HANGARS at the above Aerodrome.

The buildings consist of brick, wood, with corrugated galvanised iron and corrugated asbestos, doors, windows, &c. &c., together with all fittings.

All materials will be required to be removed and the sites reinstated to the satisfaction of the Roads and Communications Officer within 12 months from date of acceptance of contract.

Tender forms and full particulars with permission to view can be obtained from ROADS and COMMUNICATIONS OFFICER, Salisbury.

Tenders should be endorsed "Lakedown" and delivered to

Roads and Communications Office, Evelyn House, Salisbury, not later than Twelve Noon, 28th August, 1923. 3218

Sale of Pumping Ma- CHINERY at HELL WATH PUMPING STATION, SOUTH CAMP, RIPON, YORKSHIRE, by PRIVATE TENDER.

This machinery consists of:—

2 National Oil Engines, Nos. 1900 and 1901, horizontal oil engines, water cooled, T.O. type, 25 H.P., 200 revs. per minute, complete with driving pulleys, 40in. by 14in., and blow lamp and spares.
2 Essa Roturbo Pumps, Nos. 4160 and 4161, turbines on centrifugal system, belt driven from engine pulley, head 110ft., revs. 1250, gallons per hour 20,000, complete with bed-plate pedestals, fast and loose pulleys and striking gear.
6 Cooling Tanks, approx. 400 gallons each.
2 Oil Tanks, approx. 400 gallons each.
1 Water Gauge, reading to 60 lb. per sq. in., also fuel head to 140 lb. per sq. in.
6 Feet Steam Pipe, 4in. diameter.
2 Sluice Valves, 6in.
2 Guards (Wire), 8ft. by 4ft. and 10ft. by 4ft.
2 Priming Cocks, 1in.
32 Feet Chequered W.I. Plates, 15in. wide.
23 Feet Chequered W.I. Plates, 18in. wide.
1 No. 4 Rotary Hand Pump.
1 Receiver fitted with gauge and safety valve for self-starting.
1 Compressor fitted with fast and loose pulley.
36 Feet Steam Pipe, 2in.

The plant can be inspected on site by prior arrangement with Roads and Communications Officer, R.E. Office, North Camp, Ripon.

Tenders, in envelopes endorsed in left-hand top corner "Tenders for Machinery at Ripon," should be addressed to the COMMANDING ROYAL ENGINEER, 13, Wenlock-terrace, York, and should reach that office by Twelve Noon on Monday, 3rd September. 3191

Assistant Engineer Re- QUIRED for the GOLD COAST by the ACCRA TOWN COUNCIL for a tour of not less than twelve nor more than eighteen months' continuous residential service, with possible extension. Salary £480, rising to £720 a year by annual increments of £30, and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Liberal leave in England on full salary. Free quarters and passages. Candidates, preferably single, age between 25 and 30, must have had good experience in municipal engineering work and preferably should possess an engineering degree.—Apply at once by letter, stating age, qualifications and experience, and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting M/12,146. 3197

Assistant Engineer Re- QUIRED by the GOVERNMENT of the GOLD COAST for the PUBLIC WORKS DEPARTMENT for a tour of not less than 12 nor more than 18 months' service. Salary £480, rising to £720 a year by annual increments of £30, and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Liberal leave in England on full salary. Free quarters and passages. Candidates, about 35 years of age, preferably single, must be qualified civil engineers, have had special experience in surface water and land drainage work and surveying.—Apply at once, by letter, stating age, qualifications, whether married or single, and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting M/12,160. 3195

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Port of London Improvement.

Electricity in Mines—No. II.

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Singapore Naval Base.

A Gyroscopic Ship Stabiliser.

Irrigation Undertaking in Western Canada.

A Marine Uptake Superheater.

Reinforced Concrete Wing Piles.

PUBLIC NOTICES

The Government of Hong KONG propose to lay tramway tracks along certain of the main roads of the Kowloon Peninsula, and are prepared to GRANT a LEASE for a term of years for full power of user thereof for RUNNING an efficient ELECTRIC TRAMWAY SERVICE thereon. The lessees will be required to electrically equip the track, supply or obtain electrical current, rolling stock, buildings, &c., maintain the track work and equipment, and operate the service to the satisfaction of the Government.

Further information can be obtained at the office of the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, to whom British firms proposing to Tender for the lease are requested to furnish particulars of similar undertakings for which they are or have been responsible, quoting as reference number Z, Hong Kong 2897. 3196

Works Manager Required by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT, for two tours of from 12 to 18 months' service, with possible extension. Salary £800, rising to £920 a year by annual increments of £40. Duty allowance of £72 a year whilst performing the duties of the office in the Colony. Free single quarters and passages. Liberal leave in England on full salary. Candidates, age not over 40, should have had charge of the carriage and wagon shops of a British railway, of the shops of a firm of carriage and wagon builders, or of a large building contractors. They should possess a considerable knowledge of mechanical engineering. They must be competent to organise and take entire control of large sawmill, carpentry, joinery and furniture workshops, and carpentry school, and generally supervise stone crushing plant and brick and tile works. Experienced foremen are in charge of these various shops and works.—Apply at once in writing, giving brief outline of qualifications and experience and stating age, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting M/11,601. It is useless for candidates without the experience and qualifications specified to apply. 3222

In the High Court of Justice, Chancery Division, Mr. Justice Romer. 1923, E. 071.

In the Matter of The EAST COAST STEEL CORPORATION Limited and Reduced;

and

In the Matter of the COMPANIES (CONSOLIDATION) ACT, 1908.

Notice is Hereby Given that a PETITION has been presented to the High Court of Justice Chancery Division for CONFIRMING the REDUCTION of the CAPITAL of the above-named Company from £5,000,000 to £4,322,814.

By an Affidavit of Henry Hodgson the Secretary of the said Company filed in this matter on the 12th July, 1923, it appears that to the best of his knowledge information and belief there was not on the 10th July 1923 (the day fixed by the Order in this matter dated the 24th July 1923) any debt claim or liability which if such date were the commencement of the Winding-up of the said Company would be admissible to proof against the said Company.

Any person who claims to have been on the said 10th July 1923 and still to be a creditor of the said Company must on or before the 1st October 1923 send his name and address and the particulars of his claim and the name and address of his Solicitor (if any) to the undersigned at the address mentioned below or in default thereof he will be precluded from objecting to the proposed reduction of capital.

Dated this 31st day of July 1923.

JOHNSON WEATHERALL STURT and HARDY, of 7, King's Bench Walk, Temple, London, E.C. 4, Solicitors for the said Company. 3206

PUBLIC NOTICES

Wilton's Patent Furnaces.

A WARNING.

THE CHEMICAL ENGINEERING AND WILTON'S PATENT FURNACE COMPANY, Limited, wish to remind the public that, not only are Wilton's Patent Furnaces themselves patented, but the designs of many parts thereof and particularly the fire-bars are registered, and may not be reproduced without permission. Each part made in accordance with a registered design is stamped or marked "Regd. 687,638, 694,726, or 694,727."

THE CHEMICAL ENGINEERING AND WILTON'S PATENT FURNACE COMPANY, Limited, HEREBY GIVE WARNING that the making or use without their permission of Fire-bars and other parts of furnaces, which reproduce their registered designs, expose the makers or users to PROCEEDINGS for INFRINGEMENT of such design, and that such proceedings will be taken without further warning. 3205

University of Birmingham.

FACULTY OF SCIENCE.

ENGINEERING DEPARTMENTS.

I. MECHANICAL ENGINEERING.

CHANCE PROFESSOR: F. W. BURSTALL, M.Sc., M.A. (Cantab.), M. Inst. C.E., M. Inst. M.E.
LECTURER: R. C. PORTER, M.Sc. (Vict.), A.M. Inst. C.E.
DEMONSTRATOR: S. J. ELLIS, B.Sc., A.M.I.C.E.
LECTURER ON MACHINE DESIGN: F. H. BODEN, B.Sc.
ASSISTANT LECTURER ON MACHINE DESIGN: HENRY BAKER, B.Sc.

II. CIVIL ENGINEERING.

BEALE PROFESSOR: FREDERICK C. LEA, M.Sc., D.Sc. (Lond.), A.M.I.C.E., A.R.C.S.
LECTURERS: R. C. PANTON, M.Sc.
H. W. COULTAS, M.Sc.
T. H. P. VEAL, B.Sc.
LECTURER ON TOWN PLANNING: W. HAYWOOD.

III. ELECTRICAL ENGINEERING.

PROFESSOR: WILLIAM CRAMP, D.Sc.
LECTURER: E. J. KIPPS, M.Sc., M. Inst. E.E.
ASSISTANT LECTURERS AND DEMONSTRATORS: O. R. RANDALL, M.Sc.
H. VICKERS, Ph.D., M.Eng.
G. M. HARVEY, B.Eng.

THE FULL COURSES EXTEND OVER FOUR YEARS, and Students who enter after Matriculation and pass successfully the Examinations at the end of each year will BE ENTITLED to the DEGREE of BACHELOR of SCIENCE in Engineering.

The SESSION 1923-24 COMMENCES on OCTOBER 1st, 1923.

For detailed syllabus of the Faculty, with full particulars of University Regulations, Lecture and Laboratory Courses, Fees, &c., apply to the REGISTRAR. 3226

University of Birmingham.

DEPARTMENT OF METALLURGY.

Professor: THOMAS TURNER, M.Sc., A.R.S.M., F.I.C.
Lecturers and Demonstrators: T. G. BAMFORD, M.Sc.
HAROLD HARRIS, M.Sc.
T. H. TURNER, M.Sc.

The Course of Study covers three years and leads to the Degree of B.Sc. in Metallurgy. There are separate Courses for Metallurgists and Metallurgical Chemists. Special attention is devoted to Iron and Steel, Copper, Brass, and Local Industries, and to preparation for Colonial and Foreign Posts.

Research and other Scholarships.

For particulars apply to the REGISTRAR. 3184

PUBLIC NOTICES

University of Aberdeen.

CRUICKSHANK LECTURESHIP IN ASTRONOMY AND METEOROLOGY.

The University Court will proceed in autumn to the APPOINTMENT of a LECTURER in ASTRONOMY and METEOROLOGY. Salary £600 per annum.

Persons desirous of being considered for the appointment are requested to lodge their names with the Secretary to the University on or before 1st November, 1923, from whom further particulars may be obtained.

H. J. BUTCHART, Secretary.

The University, Aberdeen. 3182

University of Aberdeen.

JACKSON CHAIR OF ENGINEERING.

The University Court will proceed in autumn to the APPOINTMENT of the FIRST INCUMBENT of the JACKSON CHAIR of ENGINEERING, the patronage of which is vested in the University Court.

The salary is the free income from the endowment estimated at not less than £900 per annum, and the Professor will be allowed to undertake consulting work.

The Professor will enter upon his duties on a date to be arranged.

Persons desirous of being considered for the office are requested to lodge their names with the Secretary to the University on or before 1st November, 1923, from whom further particulars may be obtained.

H. J. BUTCHART, Secretary.

The University, Aberdeen. 3181

City of Bradford.

TECHNICAL COLLEGE.

APPLICATIONS are INVITED for the APPOINTMENT of ASSISTANT LECTURER in the Department of Civil Engineering, Architecture and Building.

An inclusive salary up to £300 per annum will be paid to a candidate of suitable qualifications and experience. Candidates should possess a good degree in Civil Engineering and have had practical experience in public works and buildings.

Full particulars of the appointment and forms of application may be obtained from the PRINCIPAL of the College. Applications, endorsed "Assistant Lecturer, Technical College," should be returned to me not later than 18th August, 1923.

3209 N. L. FLEMING, Town Clerk.

The Yarrow Scholarships.

The Council of the Institution of Civil Engineers are prepared to consider APPLICATIONS for NOMINATIONS to the above SCHOLARSHIPS. These should be submitted before the 1st October, 1923, to the SECRETARY of the INSTITUTION, at Great George-street, Westminster, S.W. 1, from whom the detailed regulations may be had on application.

The Yarrow Scholars must be British subjects, who, desiring to become engineers, lack sufficient means to enable them to pursue their practical or scientific training.

The Scholarships are of a value varying from £50-£100 per annum. 3185

Bengal-Nagpur Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for: 300 PAIRS WHEELS AND AXLES.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 2nd August, 1923.

A fee of £1 1s. will be charged for the specification, which is not returnable.

Tenders must be submitted not later than Noon on Thursday, 16th August, 1923.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board, R. C. VOLKERS, Secretary.

3216

City of Dundee.

RAILWAY BRIDGE OVER KINGSWAY.

TENDERS are INVITED from competent Bridge Contractors for the EXCAVATOR, MASON, STEEL, and other incidental WORKS for the above PLATE GIRDER BRIDGE in two spans of 82ft.

Copies of the general conditions, specification, bill of quantities, and form of Tender may be obtained and drawings examined upon application to the undersigned after Saturday, 4th August, on payment of £5 deposit, which will be returned on receipt of a bona fide Tender.

Contractors wishing to be shown over the site of the proposed works are requested to meet the Engineer at the site on August 10th at 2.30 p.m.

Tenders, sealed and endorsed "Kingsway Bridge," to be lodged with the Town Clerk, City Chambers, Dundee, not later than 10 a.m. on Monday, 3rd September, 1923.

The Council do not bind themselves to accept the lowest or any Tender.

GEORGE BAXTER, J.P., M. Inst. C.E., City Engineer.

Municipal Offices, 91, Commercial-street, Dundee, 30th July, 1923. 3204

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PUBLIC NOTICES

Clare Mental Hospital Committee.

NOTICE TO CONTRACTORS.

The Clare Mental Hospital Committee invite TENDERS from competent contractors for the :—

1. (a) SUPPLY and INSTALLING of TWO 50 H.P. SUCTION GAS ENGINES.
   (b) TWO SUCTION GAS PLANTS to feed 50 H.P. Engines.
   (c) TWO (Direct-coupled) 220-Volt DYNAMOS for above Engines.
   (d) TWO DYNAMO SHUNT REGULATORS.
   (e) ONE ELECTRIC MOTOR FAN for Gas Plants.
2. (a) ONE D.C. SWITCHBOARD, including all SWITCHGEAR (Metal Gates and Screens).
   (b) ONE MOTOR GENERATOR rated 144 amp./90 volts, including Starter and Shunt Regulator.
3. (a) STORAGE BATTERY, 118 cells, 640 A.H. capacity.
4. (a) WIRING of BUILDINGS and OVERHEAD WIRING to POWER-HOUSE.

The Committee has, for the purpose of expediting the work, subdivided the general contract into four separate contracts, namely 1 to 4, and contractors may Tender for any one or the whole contract.

The work to be carried out according to the plans and specification prepared by Mr. T. Hannon, Engineer.

Plans and specification may be inspected at the offices of the Clare Mental Hospital Committee, Ennis, Co. Clare.

The successful contractor or contractors will be required to enter into a bond for the due fulfilment of the contract.

Sealed Tenders, addressed "Chairman, Clare Mental Hospital Committee, Ennis," and marked "Electric Lighting," must be delivered not later than August 14th, 1923.

The Committee do not bind themselves to accept the lowest or any Tender.

By Order,
F. O'MARA,
3200 Resident Medical Superintendent.

Metropolitan Water Board.

PROVISION OF 7-TON STEAM CRANE, LEA BRIDGE, CLAPTON, N.E.

The Metropolitan Water Board invite TENDERS for the SUPPLY, TESTING, and SETTING to WORK of a STEAM-DRIVEN LOCOMOTIVE SHUNTING JIB CRANE of 7 tons capacity at their Lea Bridge Pumping Station.

Forms of Tender and conditions of contract may be obtained on and after Saturday, 21st July, 1923, from the Chief Engineer, New River Head, 173, Rosebery-avenue, E.C. 1, by personal application (Room 155) or upon forwarding a stamped addressed brief envelope.

Tenders, enclosed in sealed envelopes, addressed to "The Clerk of the Board, Metropolitan Water Board, New River Head, 173, Rosebery-avenue, E.C. 1," and endorsed "Tender for Crane," must be delivered at the Offices of the Board not later than 11 a.m. on Friday, 10th August, 1923.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
New River Head,
173, Rosebery-avenue, E.C. 1,
20th July, 1923. 3141

State Electricity Commission

OF VICTORIA.

TENDERS FOR PLANT.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Morwell Power Scheme.

Copies of Tender form and specification will be available upon application to :—

Agent-General for Victoria,
Melbourne-place, Strand,
London, W.C. 2.

SPECIFICATION NO. 23/117.—22,000-VOLT INSULATORS.

CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract, specification complete. These charges will be returned on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each.

PRELIMINARY DEPOSIT.—A preliminary deposit of £50 is to be lodged with the Tender.

The specification may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than Noon on 6th October, 1923.

E. LIDDELOW,
Secretary,
State Electricity Commission of Victoria,
Melbourne, Victoria,
3074 Australia.

SITUATIONS OPEN

WANTED, TWO WATERWORKS ENGINEER'S ASSISTANTS. Public works experience essential, good surveyors, levellers, and draughtsmen.—Apply, stating age, qualifications, experience, and salary required, to ENGINEER, Fylde Water Board, Blackpool. 3163 A

WANTED, Expert DESIGNER for Woodworking Machinery by first-class makers. Generous terms to suitable applicant.—Write, stating age, qualifications, references, and salary required, to Box 126, Willing's, 30, King-street, Covent Garden, W.C. 2 3219 A

ASSISTANT ENGINEER REQUIRED for India, capable of Supervising the Erection of Factories and Machinery. Should have practical acquaintance with Gas and Oil Engines and Tea Machinery and have experience of estimating and drawing. Preference to B.Sc. or A.M.I.M.E. Applicants must be single and under 26. State qualifications fully in letter of application.—Address, 3229, The Engineer Office. 3229 A

CHEMICAL ENGINEER of Good Standing REQUIRED for Large Chemical Works. Consideration will only be given to those candidates who submit detailed evidence of sound and extended scientific knowledge of Engineering Theory, including problems involving the calculation of thermal cycles, measurement of gas flows, &c., together with the application of these principles to the precise design of chemical plant for working at high efficiencies.—Address in confidence, stating salary required, 3188, The Engineer Office. 3188 A

CIVIL ENGINEER WANTED, Thoroughly Competent, for large Pipe Line Contract. Only thoroughly qualified man, able to control men and costs, need apply. Salary £450 per annum to commence.—Box G 936, Lee and Nightingale, Advt. Offices, Liverpool. 3211 A

CONTRACTOR'S ENGINEER REQUIRED for large Contract in London district. Thorough experience in the administration of a contract including extensive excavation, concrete and general building work essential. State age, experience, and salary required, with references.—Address, 3187, The Engineer Office. 3187 A

COMMERCIAL MAN of Ability, Willing to Take Sole Charge of Motor Cycle Works of good repute, also able to invest substantial sum of money with the company, which is at present in production.—Address, 3214, The Engineer Office. 3214 A

FIRST-CLASS TRAVELLER REQUIRED; Must have sound connection with engineering trade and refrigerator users. State full particulars, ground, remuneration required.—Address, P7829, The Engineer Office. P7829 A

REPRESENTATIVE WANTED for a Progressive Foundry in the Midlands making non-ferrous castings. Must have a first-class connection and be able to influence good business in the motor and engineering trade. Commission basis.—Address, P7827, The Engineer Office. P7827 A

SITUATIONS OPEN (continued)

WORKS MANAGER REQUIRED for Railway in South America, with good prospects of advancement. Salary 2000 milreis per month currency. Age 30-35 years. Qualifications must include apprenticeship, drawing-office experience (at least two years), certified technical training. Experience in charge of workshops or equal.—Reply by letter in first instance, giving full particulars of education, training, and experience, to Messrs. FOX and MAYO, Consulting Engineers, 155, Dashwood House, New Broad-street, London, E.C. 2. 3221 A

WANTED, DRAUGHTSMAN, Junior, General Engineering; neat, accurate, good tracer; West of England.—Address, stating age, experience, and salary required, P7824, The Engineer Office. P7824 A

WANTED by Engineering Firm in the Midlands, a SENIOR DRAUGHTSMAN, fully experienced and accustomed to the Design and Detailing of all types of Elevators, Conveyors, Screens, Storage Hoppers, and general mechanical engineering requirements. State age, salary required, when at liberty, and give fullest details of experience.—Address, 3145, The Engineer Office. 3145 A

WANTED, EXPERIENCED MECHANICAL DRAUGHTSMAN, accustomed to Machinery Design and to making full working drawings; must be quick and accurate.—Address, stating age, experience, and salary expected, 3223, The Engineer Office 3223 A

WANTED for General Engineering, MECHANICAL DRAUGHTSMAN. Must have gone through the shops. State age, salary, when commence. Not more than three copies references, not returnable.—Address, 3212, The Engineer Office. 3212 A

DRAUGHTSMAN, First-class, REQUIRED for Aircraft Design Work.—Please state age, experience, and salary required to WESTLAND AIRCRAFT WORKS, Yeovil. 3201 A

DRAUGHTSMAN WANTED, Accustomed to Colliery Screening Plants, Headgears and Structures.—State experience, references, when at liberty, and salary to G. R. TURNER, Ltd., Langley Mill, Notts. 3199 A

DRAUGHTSMAN WANTED, First-class Man, with good experience of High-speed Steam Engines and General Engineering Work. Age 28-40 years. Thoroughly experienced men only need apply. State age, salary, references.—Apply, EASTON and JOHNSON, Ltd., Taunton. 3189 A

DRAUGHTSMAN WANTED, with Good Experience in Machine Design.—WILKINS and MITCHELL, Darlaston, S. Staffs. P7806 A

EXPERIENCED FAN ENGINEERING DRAUGHTSMAN REQUIRED. One with knowledge of Structural Work preferred.—Address, 3330, The Engineer Office. 3330 A

SENIOR DRAUGHTSMAN, with First-class Experience in the Design of Portland Cement and Ore Crushing Machinery. Only experienced men need apply. State age, experience, and salary expected.—Address, 3215, The Engineer Office. 3215 A

TEMPORARY STRUCTURAL DRAUGHTSMAN WANTED AT ONCE in London for Detailing Steel-frame Building. State wages, experience, and when at liberty.—Address, 3224, The Engineer Office. 3224 A

THE CHATWOOD SAFE COMPANY, Limited, Bolton, REQUIRE the SERVICES of a well-trained MECHANICAL DRAUGHTSMAN with initiative and proved designing ability.—Applications should be addressed to "CHIEF DESIGNER," stating age, experience, and salary required. P7787 A

IRON and BRASSFOUNDERS, You Stand as an Asset to the Engineering Industry. Send for "The Foundryman's Educator." Make your efficiency complete. Information most reliable on all foundry matters. Post free 6s.—GREAVES, Harefield Hall, Heywood, Lancs. P7812 A

SITUATIONS WANTED

A.M.I.C.E., 14 Years' First-class Experience, Including steel erection, steel and concrete buildings, heavy foundations, railway work, &c., WANTS POST, home or abroad. Fluent Spanish, used to organisation and control of labour. Could invest some capital after trial period, if desired.—Address, P7796, The Engineer Office. P7796 B

A YOUNG INDIAN, Experienced in Permanent Way works (maintenance and construction) and shop, both in Indian and English railways, SEEKS APPOINTMENT as P.W. INSPECTOR in India or Burma.—Address, P7810, The Engineer Office. P7810 B

CIVIL ENGINEER, University Man, 18 Years' experience hydraulic, port and irrigation works, speaking English, French, Spanish and Portuguese.—Address, P7819, The Engineer Office. P7819 B

CIVIL ENGINEER on Furlough REQUIRES TEMPORARY WORK, either erection job or research work preferred, for about 8 months, at home or abroad. Nominal salary will be accepted.—Address, P7809, The Engineer Office. P7809 B

CIVIL ENGINEER, with 13 Years' Experience in reinforced concrete, at present in U.S.A. with one of America's leading foundry engineers, WANTS to return to England to take over POSITION as CONSULTING ENGINEER with industrial firm or Take Charge of Reinforced Concrete Contractor's Engineering Dept. —Address, P7816, The Engineer Office. P7816 B

COMPETENT MACHINERY DESIGNER REQUIRES POST, temporary or otherwise. Capable designing throughout, any machine, for any purpose. Long, varied, extensive experience. Specialist new, original design; patent expert. Salary £7.—Address, P7807, The Engineer Office. P7807 B

ENGINEER (28), General Experience and Sound theoretical knowledge, WANTS POST with prospects, home or abroad.—Address, P7825, The Engineer Office. P7825 B

ENGINEER, Twenty Years' Experience all Kinds construction, maintenance and plant erection, REQUIRES POSITION of TRUST.—Address, P7818, The Engineer Office. P7818 B

ENGINEERING FIRMS REQUIRING the Permanent or occasional SERVICES of a fully qualified CONSULTING and MECHANICAL ENGINEER as London Representative are invited to write to P7822, The Engineer Office. P7822 B

MANUFACTURERS' REPRESENTATIVE, with A office in Manchester, WISHES to GET in TOUCH with ENGINEERING FIRMS desiring REPRESENTATION in Lancashire and Cheshire.—Address, P7805, The Engineer Office. P7805 B

M.I. MECH. E., with Wide Commercial Experience, speaking French, Spanish and Italian, DESIRES responsible POSITION in London or would travel; active and robust.—Address, P7821, The Engineer Office. P7821 B

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For continuation of For Sale Advertisements see page 3

A Seven-Day Journal

The Vaal River Barrage.

On Friday last, July 27th, the new Vaal River barrage of the Rand Water Board at Vereeniging was formally opened by Prince Arthur of Connaught, the Governor-General of South Africa. The construction of this barrage and the manner in which the work was carried out, as well as the pumping station and pipe lines connected with the scheme, were described in an article by Mr. W. Ingham, the chief engineer of the Rand Water Board, which appeared in The Engineer of December 1st, 1922, and was illustrated by a special Supplement. The barrage is constructed about 25 miles down-stream from the Vereeniging railway bridge, creating a lake of 40 miles in length, with a surface area of 6¼ square miles, and sufficient water is impounded in the reservoir to provide 20 million gallons per day, after the needs of the riparian owners in the reservoir area have been supplied. The barrage consists of a series of piers with mild steel sluice gates erected between them. It is 1400ft. in length, and has thirty-five piers and two abutments. The thirty-six openings thus formed are furnished with gates. Each pier is 8ft. thick, 34ft. high and 55ft. long, and the gear for opening the gates is placed on a platform 35ft. above the piers. The water is abstracted at Vereeniging, 23¼ miles up-stream from the barrage, where the main pumping station is situated. After sedimentation, chemical treatment and filtering, the water is pumped to the five service reservoirs, which supply the Rand. The cost of the entire scheme is stated to be over £1,500,000.

British Shipping Trade.

According to a preliminary review of the annual navigation and shipping returns of the United Kingdom, which was recently published by the *Board of Trade Journal*, there was during 1922, an increase both in tonnage cleared with cargoes and in the proportion of foreign tonnage to the total tonnage, as compared with 1921. It is stated that such increases may be largely due to resumed activity in the coal export trade. In 1921 British vessels aggregating 25,124,000 net tons entered our ports with overseas cargoes, while clearances during the same period were 24,282,000 net tons. The preliminary figures for 1922 show that a total of 28,422,000 net tons entered and 36,815,000 net tons with cargoes were cleared in that year. Foreign vessels of 11,999,000 net tons entered with cargoes in 1921, while clearances were 12,115,000 net tons. The figures for 1922, as given in the monthly trade accounts, show for foreign ships an aggregate of 14,904,000 net tons entered with cargo and 22,865,000 net tons cleared. In the year 1913, however, the proportion of foreign tonnage to the whole was even greater than that shown by the 1922 figures.

The Diggle Railway Accident.

A verdict of "Accidental death" having been returned in the case of the two passengers and two enginemen killed in the Diggle collision of the 6th ult., it may now be remarked that the accident has revealed a weakness in the working rules. The driver was pulled up at the water column by the exhibition of a red flag from the signal-box. The column is about 240 yards in advance of the home signal, and there is no signal between the column and the junction from the up north to the up south line. As three other running lines intervene between the box and the up south line, the flag had to be taken in or it might have caused confusion to other trains—as, for instance, the express that met with the accident, and which had to pass on the up north line, the second from the box. The driver of the goods train—who was among the killed—when he received the "right-away" signal from the shunter, evidently took the absence of the red flag as permission to move. There is no regulation in the rule book to cover these conditions, and it would seem that one should be made that when a train has been stopped by a red flag or other hand signal by the signalman, and no fixed signal is available to control its further movement, the driver must not move without the signalman's verbal instructions.

The Boilermakers' Lock-out.

The lock-out of members of the Boilermakers' Society from the federated shipyards has now continued for nearly three months, and, according to a circular issued last week from the Society's headquarters at Newcastle, there is every prospect of the dispute being carried on throughout the autumn. The executive committee states that all possibilities of negotiating a settlement are now at an end, and that every attention must be given, both locally and nationally, to organise the dispute to a successful conclusion. Reference is made to certain federated firms having withdrawn their notices, but a statement issued on behalf of the Shipbuilding Employers' Federation on Monday, pointed out that only one firm, situated in an isolated district and employing only a very limited number of boilermakers, had adopted that course. The further statement was made that, while the Boilermakers' Society has been invoking the aid of outside agencies, its own trades federation has expelled the Society for refusing to honour an agreement which it had entered into on behalf of all its members—including the Boilermakers' Society—with the Employers' Federation.

A Metropolitan Water Board Contract.

In connection with the construction of eighteen concrete primary rapid filters and other works at Walton-on-Thames, it is announced that the lowest tender for the work was that received from the Danish firm of Christiani and Nielson, Victoria-street, Westminster, who quoted £116,114 19s. 2d. The next lowest tender was £126,176 14s. 3d., quoted by J. Parkinson and Sons, Limited, Blackpool. At the meeting of the Board held on Friday last protests were made against the recommendation of the Works and Stores Committee that the tender of Christiani and Nielsen should be accepted. An amendment proposed that the recommendation be referred back for reconsideration was, however, defeated by 27 votes to 11, and the committee's view was approved, with an addendum that all labour employed in connection with the contract should be British labour. It was also stated that provision had been made for the use of a large percentage of British manufactured cement.

Two Colliery Explosions.

We regret to have to place on record two serious colliery explosions which happened on Saturday last, one at Maltby Main Collieries, near Rotherham, and the other at Gartshore Colliery, near Kilsyth, Stirlingshire. For some weeks past considerable trouble has been experienced at the Maltby Colliery with a serious gob fire, and on Tuesday, July 17th, coal getting was suspended, and all attention was given to dealing with the fire. It had been decided to seal the affected area, and to fix stoppings so that air might be precluded, and, if necessary, inert gas might be injected into the burning material. This work was in progress when about 10 o'clock on the morning of Saturday an alarming explosion took place, cutting off access to the men working near the gob fire. At the time of the accident about 120 men were in the pit, and 27 men lost their lives. So far only one body has been recovered, and it has been necessary to entirely seal the eastern area of the mine where the accident took place. At No. 3 Gartshore Pit, near Kilsyth, belonging to William Baird and Co., Limited, a new lodgment for water was being completed, when a sudden explosion took place, killing 11 of the squad of bricklayers and labourers who were working on job in hand. So far no cause has been assigned for either of the two explosions.

The Imperial Airship Scheme.

Apparently the long discussed Imperial airship scheme will now go forward, for the Government, acting on the advice of the Imperial Defence and the Imperial Shipping Committee, has now decided to resume the development of airships, and has accepted in principle a scheme whereby a bi-weekly service of six large airships to India will eventually be set up. The scheme put forward by Commander Burney will, we understand, receive the financial support of Vickers, Limited, and the Shell Company. It is proposed to form an Airship Company with a capital of £400,000, of which £200,000 will be paid up, while the Government will provide £400,000. The first work will, it is said, be to erect mooring masts and then proceed to build a rigid airship of 5,000,000 cubic feet capacity—capable of carrying 130 to 150 passengers and mails. A speed of 80 miles per hour and a range of 2500 to 3000 miles is anticipated in the new design. According to estimate, it is said that the first ship can be built in eighteen months, and subsequent vessels will not take more than about four months to construct. Three ships will be needed for a weekly service and six ships for a bi-weekly service to India. It is understood that the proposed company will take over the aerodomes at Pulham and Cardington.

Continental Trade.

From whatever standpoint the situation is regarded, it is clear that international trade can only recover by reorganising the elements of activity that are lying dormant on account of the financial difficulties which exist all over the Continent. Alike in Central Europe and in Italy and France, there are great possibilities in the way of selling British goods, if only the money values of those countries would permit of their purchasing them. All over the Continent the needs have increased while the purchasing power has diminished, and the vast schemes involving a huge expenditure upon the construction of railways, ports and public works generally, are for the most part held in abeyance because it is impossible for the moment to procure the necessary funds. In France and in Germany, where the money is spent at home, the carrying out of engineering undertakings is not interfered with by the financial stringency to the same extent as in Central Europe. In Roumania, Poland, Czecho-Slovakia, and more especially in Russia, most of the machinery and other requirements have to be purchased abroad, either from countries with an appreciated currency or from Germany, and it is obviously to the interest of British firms to secure those markets if it is possible to do so with the aid of some mutual agreement. During the past week an important step has been taken by the British Government in the way of commercial reorganisation by signing a treaty with Czecho-Slovakia. Such treaties, however, can only become effective in the event of money values permitting of an interchange of goods, and there is no doubt that if the present negotiations with France and Belgium over reparations should stabilise the situation, the way will be prepared for a system of reciprocal arrangements which will inspire confidence and allow of an industrial reconstruction in many European countries that cannot fail to have a good effect upon European trade. At the same time the manufacturing resources of Europe have so enormously increased during the past few years that British firms will find competition for trade far more severe than it was before the war.

A Gift to the Imperial College.

A valuable donation, which should further the interests of research and science teaching as applied to engineering and industry, was announced during the week. The Clothworkers' Company of the City of London has offered an annual contribution of £3000 for the period of five years 1923–1927 to the governing body of the Imperial College of Science and Technology, South Kensington. This grant is to be applied towards the maintenance and development of the Central Engineering College, one of the three constituent bodies of the Imperial College of Science.

The Railway Dispute.

Things have taken a more satisfactory turn in connection with the demands of the National Union of Railwaymen, that the award No. 728 of the Industrial Court should be applied to the railway shopmen on the old Great Northern section of the London and North-Eastern Railway Company's system. Representatives of both the N.U.R. and the craft unions met officials of the railway company, when matters were discussed. On Tuesday the executive of the N.U.R., at the request of the Minister of Labour, met Sir Montague Barlow, and acquainted him with the fact that no settlement of the dispute had been reached. As notices calling out the men were timed to expire the same evening, the Minister suggested that, as a preliminary measure, time must be afforded him in which to exercise his good offices, and he accordingly proposed that the strike notices be withdrawn. The executive agreed with this not unreasonable request, and temporarily withdrew the notices, relying on the promise of the Ministry to use its offices in effecting a settlement. The railway company has suggested that the matter in dispute be referred to the Industrial Court, and the N.U.R. are favourably inclined towards this course. The craft unions, however, do not consider such reference would provide a solution of the difficulties involved.

Reduction in Coal Rates.

For some time past negotiations have been in progress between the colliery owners and the railway companies, with a view to bringing about a reduction in rates charged for the transportation of coal and other fuels. At a conference held in London on Tuesday, July 31st, the case for a reduction was put before representatives of the railway companies by the Mining Association, when a statement was made supporting the claim for lower rates by facts and figures. It has now been officially announced that the London and North-Eastern Railway Company, the Great Western, and the Southern Railway Company intend to reduce their rates for the carriage of merchandise traffic by merchandise train—including coal, coke and patent fuel—on and from August 7th, 1923. The rate is to be reduced from 60 per cent. above the rates in force on January 14th, 1920, to 50 per cent. above those rates. The London, Midland and Scottish Railway introduced the reduction on August 1st.

Joint Industrial Councils.

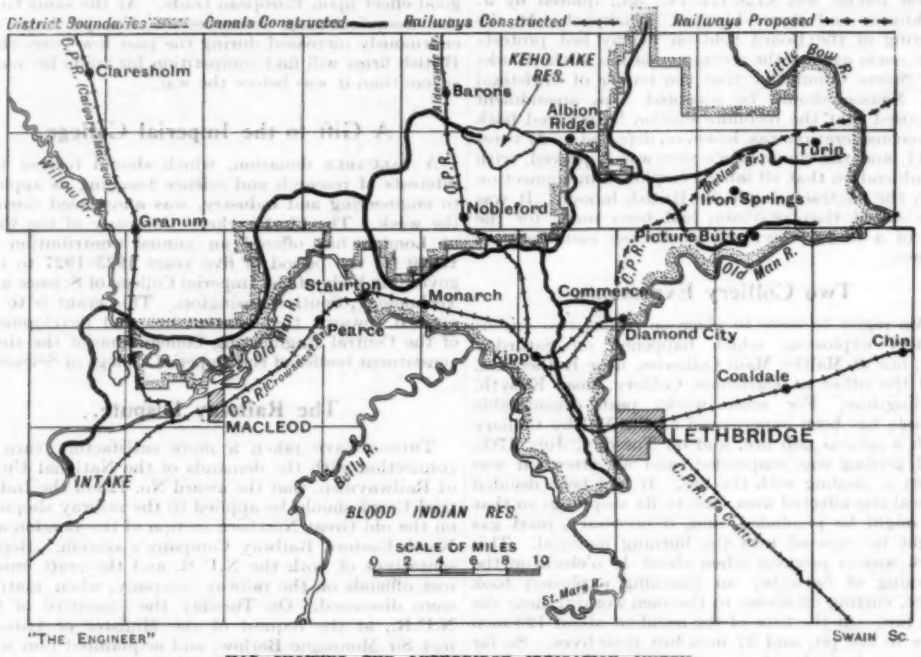
A report just issued by the Ministry of Labour deals with the establishment and progress of joint industrial councils, and embraces their operation from the appointment of the Whitley Committee in October, 1916, until the end of 1922. Of the seventy-three councils hitherto established, all excepting fifteen are continuing to operate. Many joint councils have done good service in standardising wages and working hours, while much other useful work has been accomplished in connection with education, training, apprenticeship, unemployment, research and statistics, and welfare problems. It is pointed out that with the continuing industrial depression the joint industrial councils may still have a difficult time before them, but a perusal of the report would seem to confirm the impression that such councils have established a definite place in industry and that they carry on an important work which bears intimately on the future relations between employers and workers.

The Lethbridge Irrigation Enterprise in Western Canada.

By F. S. DYKE, Assoc. M. Eng. Inst. of Canada.

No. I.

THE Lethbridge Northern Irrigation District, created under the provisions of the Irrigation Act of Alberta, 1915, recently completed the construction of a system designed to irrigate about 105,000 acres in the vicinity of Lethbridge, a town of some 12,000 inhabitants, in Southern Alberta, and lying about 50 miles north of the international boundary. Under the provisions of the above-mentioned Act, the Government of the Province authorises the formation of a district on the petition of the owners of at least half of the proposed district, and in the present case guaranteed by a special Act the issue of debentures for the construction and maintenance of the necessary works. In every case the management of a district is vested in a board of trustees consisting of three or more ratepayers, who act under the supervision of an irrigation council, the members of which are appointed by the Lieut.-Governor in Council. This being the largest project as yet constructed under the provisions of the above-mentioned Act, a brief description of it may be of interest.



MAP SHOWING THE LETHBRIDGE IRRIGATION SYSTEM

The area included in the district in question consists of fairly level prairie land, the soil for the most part being a somewhat light sandy loam, very liable to wind erosion and drifting when under cultivation. The whole area has been fairly well settled for some years, and bumper wheat crops were secured in 1915 and 1916, the rainfall during the growing season in those years being 13.59in. and 18.27in. respectively. Since that time, however, an unbroken succession of years of insufficient precipitation has resulted in a series of crop failures, and the serious embarrassment of nearly every farmer in the district, many of whom have been forced to move elsewhere. The "duty of water" has, therefore, been fixed for an irrigation allowance of 18in., or 1.5 acre-feet per season, which, employing an irrigation factor of 80 per cent., fixes the net capacity of the canals at 1 cubic foot per second—1 cusec—per 120 acres of irrigable land. This amount applied to the land during the cropping season is equivalent to an artificial rainfall nearly as great as that of 1916, and would secure good crops even if no rainfall occurred during the growing months.

The water supply is taken from the Oldman River, at a point in the Peigan Indian Reserve, about 40 miles west of Lethbridge, where the intake works consist of a reinforced concrete diversion weir, combined with sluice gate and head gates for the main canal. The diversion weir, which is 650ft. long, rests on a pervious foundation of coarse gravel and boulders, and provision has been made for a possible maximum flood of 40,000 cusecs, representing 6½ft. in depth over the crest. The sluiceway is controlled by three Stoney gates, 26ft. wide, operated by hand winches, while four similar gates, 10ft. wide, admit water to the main canal. The main canal has been designed for a capacity of 807 cusecs on a gradient of 0.02 per cent., the bed width being 31ft., depth of water 7ft., and side slopes 1½ to 1. The value of n was taken as 0.0225, giving a velocity of 2.85ft. per second. For the first four miles the canal is in steep side-hill construction with one bank, the cut on the high side approaching 40ft. in depth in some places, the maximum height of fill being 33ft. The top of the bank was made 14ft. wide for this stretch, with outside slopes of 3 to 1 for the higher fills. The material excavated was of a very gravelly nature, with an admixture of large boulders, and the loss by seepage on this part of the canal will no doubt be great for the first year or so. A Bucyrus 2-yard drag-line excavator was used on this section. It started work on September 15th, 1921, and completed its contract of 380,000 cubic yards in eight months, working double shifts. This machine did excellent work in material which it would have been impossible for teams to handle, both owing to the cemented nature of much of the gravel and to the fact that for the first 1½ miles much of the excavation was under water work, caused by seepage from the river. Much of the bottom land near the intake was heavily timbered, and a considerable amount of clearing and grubbing ahead of the drag-line was necessary, all stumps beneath the fill being removed by blasting. An Indian graveyard was also encountered; the remains had to be collected and interred elsewhere as, according to the Blackfoot custom, the coffins were lodged in the branches of the trees.

At Sta. 196 the canal crosses from the south to the north bank of the river by means of a semi-circular steel flume, 14ft. 4in. in diameter and 3385ft. long. This flume is carried by steel trestles on concrete pedestals, except over the main channel of the river, where seven steel lattice-work girders of 120ft. span supported by reinforced concrete piers, were used.

STEPPED DROP

The flume itself is constructed of 14-gauge galvanised steel sheets, the gradient given being 0.17 per cent., resulting in a theoretical velocity of 11.46ft. per second, and a total loss of head between inlet and outlet of 7.03ft. At this point the full supply level in the canal is about 40ft. above mean water level in the river. For the next 10 miles the canal was excavated by a Marion 2-yard drag-line working in connection with elevating grader and dump wagon equipments. In this stretch several well-marked natural drainage channels were encountered, and in the high fills at these places the dump wagons made the haul ahead of the drag-line, provision for dealing with the spring run-off being made by placing corrugated iron culverts with reinforced concrete portals beneath the canal, or, in the case of the most marked channels, by means of concrete box culverts.

At Sta. 787, Willow Creek, a tributary of the Oldman River, is crossed by means of a similar flume to that described above, being 592ft. long, and carried by four lattice-work girders, each of 80ft. span, supported on concrete piers over the stream itself, and on timber trestles over the low-lying east bank. The remaining 2200ft. of this valley is crossed by means of an earth levee, the maximum height of which at the outlet portal is 25ft. The majority of the material for this fill was obtained from the 4000ft. of heavy cutting in the canal adjoining the east bank of Willow Creek, being excavated by a 75-ton Bucyrus steam shovel with a 2-yard bucket, the spoil being loaded into 4-yard cars hauled by dinky engine and dumped from temporary trestles built along the centre line of each bank of the levee. Each layer was thoroughly sprinkled, a pumping plant being installed at the Creek for this purpose. The total quantity in this fill was 140,000 cubic yards. This stretch was completed in eighty working days of day and night shifts.

At Sta. 856 the canal passes beneath the Canadian Pacific Railway's Macleod Calgary Line, the track being carried by a double plate girder bridge on concrete abutments, and for 20 miles thereafter runs in a north-east direction in a fairly easy country, where a reasonable balance between cut and fill was obtained. This stretch was excavated by a Monaghan 2-yard drag-line and a 1½-yard Bucyrus caterpillar steam shovel, working in conjunction with elevating grader and team equipments.

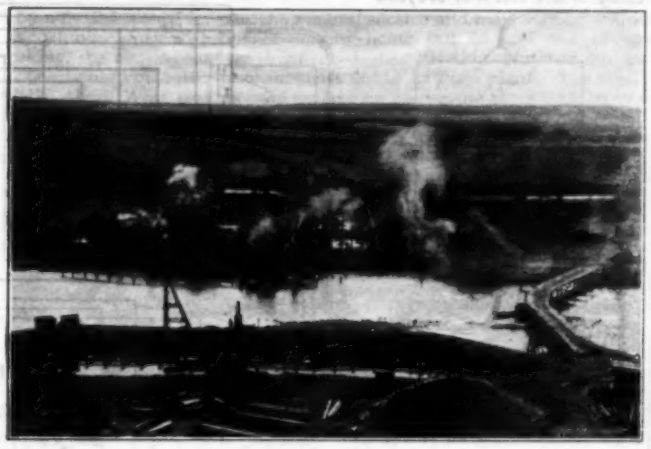
At Sta. 1947 a deep ravine, about ½ mile long, is crossed in double fill with a maximum height of 25ft. The material for this fill, about 150,000 cubic yards, was excavated from shallow borrow pits on both sides of the canal by means of an elevating grader operated by a steam traction engine, this spoil being hauled into the fill by fourteen dump wagons. A still deeper coulee is then negotiated by means of a wood stave syphon 10½ft. in diameter and 2855ft. long, carried by timber cradles bolted to concrete pedestals. The inlet and outlet portals were of reinforced concrete. A similar syphon, 930ft. long, has been used across an old lake bed some 2 miles further on. For the next 9 miles little difficulty was encountered in obtaining a fairly balanced line, the excavation being sublet to numerous small team and horse-drawn grader equipments. A bold cut is then made through a high ridge to give access to the shallow depression known as Keho Lake Reservoir, in which the main canal terminates.

The heaviest cutting on the above stretch of less than 2 miles is 40ft., the total quantity in excavation being 650,000 cubic yards. This work was very efficiently handled by a 4-yard Bucyrus drag-line working twelve months with continuous double shifts, the spoil being wasted in high banks each side of the cut, a 15ft. berm being left between bank and excavation. A fairly hard sandstone rock was encountered about 10ft. below the surface, a satisfactory method of dealing with this material being evolved by drilling 6in. bore-holes 40ft. apart on the centre ahead of the drag-line, and extending from the surface to a foot below grade. Charges up to 1500 lb. of dynamite were then fired in these holes, which left the rock shattered to an extent which rendered it easily handled by the drag-line bucket. The absence of any local source for feed water for steam raising was overcome by obtaining water from the Oldman River at Lethbridge, about 20 miles distant, in 8000-gallon tank cars, hauled by the Canadian Pacific Railway, a branch line of which was again crossed at this point by means of a plate girder bridge on concrete piers.

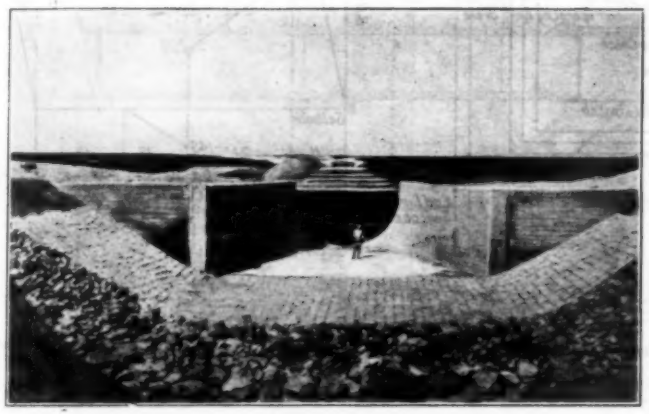
At about 53 miles from the intake the main canal finally discharges into the above-mentioned Keho Lake reservoir, which covers an area of 3690 acres

THE LETHBRIDGE IRRIGATION UNDERTAKING

GENERAL VIEW OF INTAKE WORKS, JUNE 1922

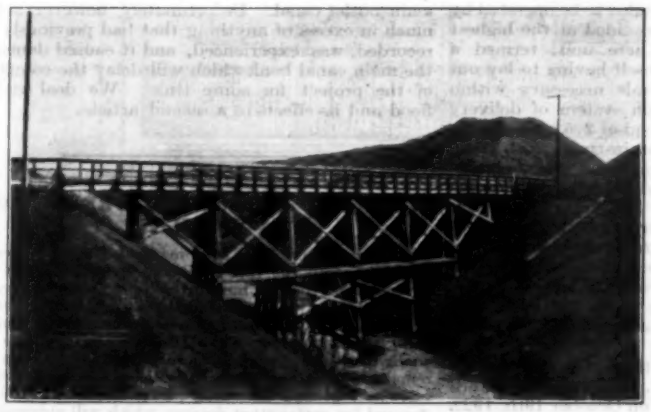


INTAKE WORKS, SHOWING COFFERDAM FOR HEADGATES, SEPTEMBER, 1922

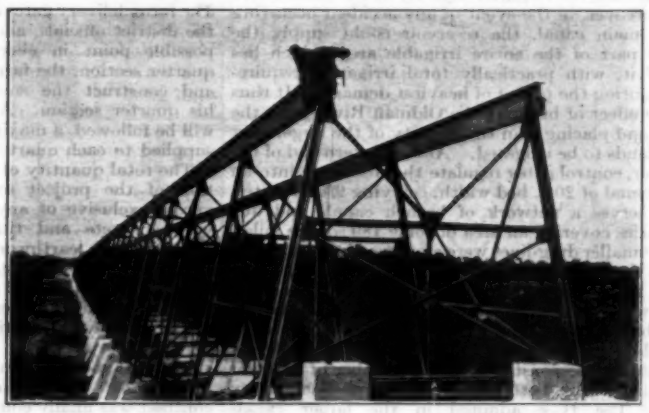


OUTLET PORTAL OF WILLOW CREEK FLUME

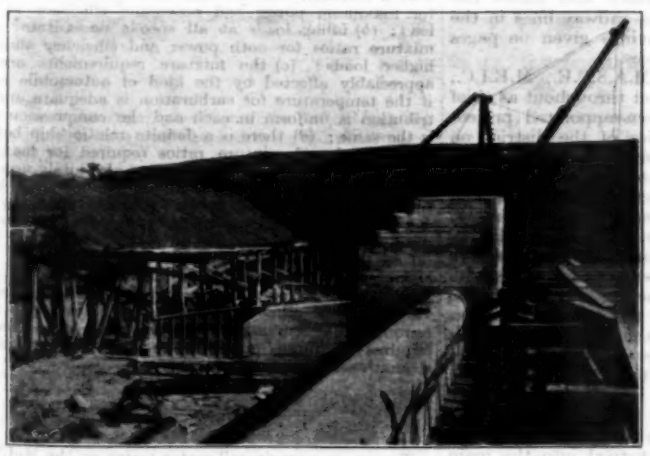
TYPICAL CROSS DRAINAGE CULVERT BENEATH CANAL



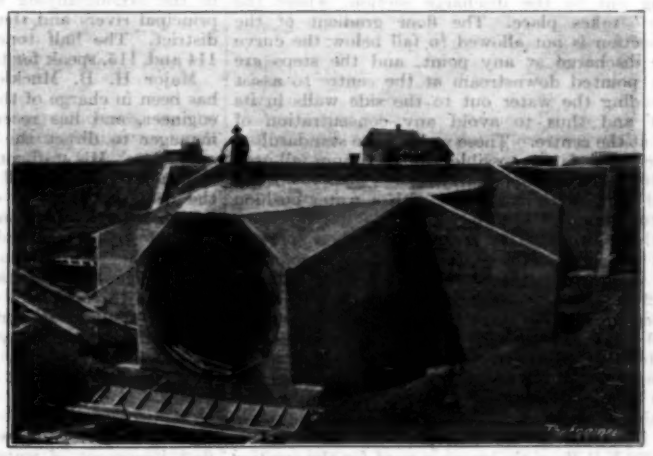
HIGHWAY BRIDGE OVER BIG CUT ON MAIN CANAL



STEEL TRESTLE WORK FOR OLDMAN FLUME



PART OF DIVERSION WEIR AT INTAKE



INTAKE PORTAL FOR 10ft. 6in. WOOD STAVE PIPE

DIAGRAM OF ELECTRIC CONNECTIONS OF WINDING PLANT AT LLANHARAN COLLIERY

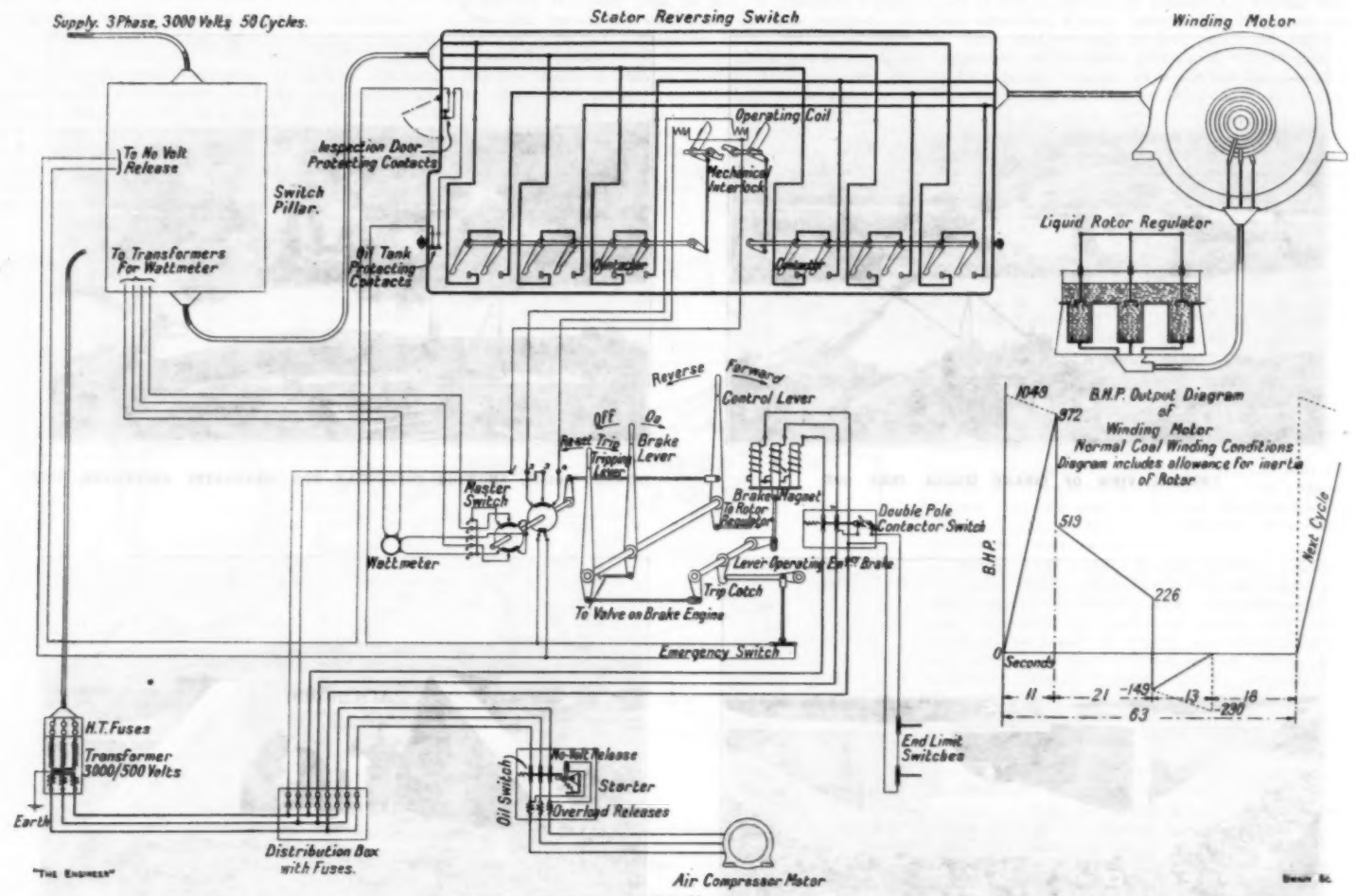


FIG. 11

and has a storage capacity of 41,000 acre-feet. This reservoir is intended to be operated as part of the canal system, and not wholly as a reserve supply, thus reducing the required capacity of the canal above it. Moreover, in the event of any accident occurring to the main canal, the reservoir could supply the greater part of the entire irrigable area, which lies east of it, with practically total irrigation requirements during the period of heaviest demand. It thus has the effect of bringing the Oldman River from the intake and placing it in the vicinity of the larger part of the lands to be irrigated. At the eastern end of the reservoir, control gates regulate the discharge into an outlet canal of 20ft. bed width, carrying 9ft. of water, which serves a network of branch canals and distributaries covering an area of some 180 square miles.

Two smaller drag-lines were employed in the excavation of the heavier portion of this outlet canal, where a very tough compacted clay formation was encountered, which in places required the use of explosives to enable the drag-lines to handle it. The relatively steep slope of the country to the east of the reservoir necessitated the construction of a number of gradient correction works, both in the branch and distributary canals. The type adopted in the larger canals depends for its efficient action on the formation of "hydraulic jumps," which were constructed of reinforced concrete in the form of stepped chutes with the control or notch section upstream gradually splaying out to the discharge section, where the "jump" takes place. The floor gradient of the chute section is not allowed to fall below the curve of free discharge at any point, and the steps are slightly pointed downstream at the centre to assist in spreading the water out to the side walls in its descent and thus to avoid any concentration of energy at the centre. These works were standardised as to height as far as possible, the maximum fall used being 10ft. In all canals carrying less than 40 cusecs, straight overfall timber drops with a water cushion downstream were employed.

On the main canal an automatic syphon spillway with a capacity of 300 cusecs was constructed at mile 1.5 to prevent any overload on the Oldman flume 2 miles below, and controlled spillways have also been provided at miles 13 and 28, with capacities of 600 and 800 cusecs respectively. Reinforced concrete head gates with Stoney gates operated by hand winches admit water to the outlets of all the branch canals, these structures being in conjunction with similarly operated check gates in the main canal immediately downstream of the outlets. 3,700,000 F.B.M. of timber were used for the erection of smaller structures, consisting of pile bridges with an 18ft. clear roadway, and designed for the load of a 24-ton tractor for all highways crossing large canals, box culverts being used on the distributaries. Small drops, farm delivery gates and small flumes comprised the remainder of the timber structures. The farm delivery gates are intended to be operated by the district officials, and are provided at the highest possible point in every 160 acre unit, termed a quarter section, the farmer himself having to lay out and construct the small laterals necessary within his quarter section. A rotation system of delivery will be followed, a maximum head of 2.5 cusecs being supplied to each quarter section in turn.

The total quantity of earth moved in the construction of the project amounted to 6,338,000 cubic yards, exclusive of any earth moved in connection with concrete and timber structures. The prices at which the earthwork contract was let were:—Common earth, 24 cents per cubic yard; loose rock, 45 cents per cubic yard; solid rock, 80 cents per cubic yard; overhaul, 1½ cents per yard sta. The cost to the ratepayers is estimated at about 47.50 dollars per irrigable acre.

The first sod was turned by the Lieut.-Governor of Alberta on June 16th, 1921, and the earthwork contract was finally completed on October 19th, 1922. It was expected that the official opening of the head gates would take place about May 1st, and that water would be available to irrigators early in June. The general lay-out of the main and branch canals is shown in the accompanying map, which also shows the principal rivers and the various railway lines in the district. The half tone engravings given on pages 114 and 115, speak for themselves.

Major H. B. Muckleston, M.A.S.C.E., M.E.I.C., has been in charge of the project throughout as chief engineer, and has recently been appointed project manager to direct the destinies of the district on operation. His staff consisted of a principal assistant in general charge of all location and construction in the field, an engineer of structures, two divisional engineers in charge of surveys, earthwork and timber, assisted by five resident engineers immediately responsible for the construction in their respective areas. The C.P.R. has recently announced its intention to commence construction of a branch line through the eastern portion of the district this year. This will very materially assist the project, the success of which will be very closely watched, not only throughout Canada but also in the west of the United States.

* * *

After the foregoing was in type, we learnt that the first increment of water was turned into the main canal on May 2nd, and that the head wave had advanced twenty-five miles in three days without any serious mishap. It was proposed to have a formal opening of the undertaking on June 16th, when the Lieut.-Governor of Alberta was expected to admit the water from the Keho Lake reservoir into the main outlet canal. Unfortunately, however, a flood, much in excess of anything that had previously been recorded, was experienced, and it caused damage to the main canal bank which will delay the completion of the project for some time. We deal with the flood and its effects in a second article.

SPEED AND PETROL MIXTURE OF MOTOR VEHICLES.

Investigations have been made at Purdue University with regard to the carburation of petrol and the effect of speed on petrol mixture requirements. They are reported to have established definitely that the change in speed of automobile engines does not affect the mixture ratio to any extent when the temperatures are high enough for good carburation, and the compression ratio remains the same. It is expected that the threatened fuel shortage and the rising price of fuel will lead to a demand for carburation devices, which will automatically give high economy as well as good power and acceleration characteristics. These investigations were made with the idea of aiding the development of such devices. Conclusions are presented as follows:—(*a*) At any given engine load a constant mixture ratio is required at all speeds for maximum power and maximum efficiency at that load; (*b*) idling loads at all speeds necessitate richer mixture ratios for both power and efficiency than the higher loads; (*c*) the mixture requirements are not appreciably affected by the kind of automobile engine if the temperature for carburation is adequate and distribution is uniform in each and the compression ratio is the same; (*d*) there is a definite relationship between engine load and mixture ratios required for maximum efficiency; (*e*) dry mixtures are not absolutely necessary for good performance, but a dry mixture will allow leaner fuel-air ratios than can be utilised when operating with wet or heavy fog conditions; (*f*) the ideal carburetter must recognise more than air flow, *i.e.*, engine load; (*g*) mixtures must be enriched for acceleration when changing to a different speed or load for economical operation; (*h*) operation under throttled conditions, excepting very low loads, allow lean ratios to be utilised, thus maintaining high economy; (*i*) when full load operation requires maximum power to be delivered the mixture strength must be enriched.

There are now six rail-motor trains on the Mid-Wales and Cambrian coast sections of the Great Western. They have an aggregate train mileage of 560 a day.

Electricity in Mines.

No. II.*

Two interesting electrical winding engines working on the alternating current system have recently been supplied by the English Electric Company to the Powell Duffryn Steam Coal Company, South Wales. One of the engines, which has been installed at the company's Llanharan pit, has been in successful operation since August, 1922, and the other, which is at the new Tredegar No. 1 pit, is now being erected. Both plants are built on the same lines, and consist of a cylindrical drum driven by an English Electric Company's three-phase induction motor through single reduction machine-cut double helical gearing and designed to work to the following conditions :—

Depth of shaft	960ft.
Output of coal per hour	143 tons
Net weight of coal per lift	50 cwt.
Net weight of rubbish per lift	70 cwt.
Number of lifts per hour	57 1/7
Time of complete cycle	63 sec.
Interval for banking	18 sec.
Net time of each lift	45 sec.
Circumference of winding rope	4 1/2 in.
Weight of rope per fathom	25.7 lb.
Weight of each cage and bridles	77 cwt.
Weight of each tram	12 cwt.
Number of trams per cage	Two
Diameter of drum	10ft.
Maximum drum speed	55.7 r.p.m.
Maximum rope speed	29 1/6 ft. per sec.
Maximum motor speed	363 r.p.m.
Supply	Three-phase, 3000/3150 volts, 50 cycles

With the usual assumptions it is estimated that when the winders are working under the above conditious, the output of the winding motor when winding coal will be as shown by the curve in the right-hand lower corner of the diagram of connections—Fig. 11. The winding motor in each case is a three-phase reversible induction machine with a slip-ring rotor, the two pedestal bearings being extended for coupling to the pinion shaft by a flexible coupling. The motor has been designed for winding duty with intermittent counter-current braking, the continuous rating being 675 horse-power. The liquid controller for each set was manufactured by Allen, West and Co., and consists of a rotor regulator, high-tension reversing switch of the oil-immersed contactor type, and lever operating gear. The driver's instruments, viz., a voltmeter and a wattmeter with the zero mark in the centre of the dial, are mounted on the depth indicator. The control frame contains a small reversing switch to change over the wattmeter connections when the stator reversing switch is operated. Each set is also provided with a three-phase oil-immersed transformer for the auxiliary circuit, a 7 1/2 squirrel-cage induction motor for driving the auxiliary air compressor, a three-phase solenoid brake magnet for operating the emergency trip gear, a double-pole contactor switch for the brake magnet circuit, three single-pole limit switches for mounting in the pit head structures, and one for use with the overwind gear, the function of these switches being to trip the brake magnet in the event of overwind. The mechanical parts of the winder were supplied by Thornewill and Warren under a separate contract.

A 250 horse-power electrically driven endless rope haulage plant has been supplied by Heenan and Froude, Limited, of Worcester, to the Whitehaven Colliery, Limited. The arrangement of the plant is shown in Fig. 12. The mechanical parts consist of a substantially designed fleeting wheel, 7ft. in diameter, which is fitted with a renewable cast steel rope tread. A notable feature of the plant is that it is fitted with a two-speed gear which gives rope speeds of three miles and eight miles per hour for the mineral service and mail service respectively, either service being put in and out of operation by high-speed disc friction clutches on the first motion shaft of the haulage plant. The mail service is used mainly for conveying the workmen in and out of the workings, a service of this kind being a considerable advantage when the working face is a great distance from the shaft bottom.

The two first sets of reduction gear form the change speed gear and consist of high carbon steel pinions and cast steel spur wheels, having teeth of the double helical type and machine cut from the solid in one continuous piece, the gears being designed to run in oil-tight cases. The second reduction gear from the intermediate to the main haulage shaft consists of a cast steel wheel and pinion having straight machine-cut involute teeth. A powerful brake operates on the fleeting wheel and an auxiliary brake operates on the first motion shaft, this brake being actuated by a brake solenoid in the possible event of the electric supply failing. For the first and second motion shafts, oil ring bearings are used and they are fitted with steps lined with anti-friction metal. The main haulage shaft bearings, which are of very strong construction, are of the angular pattern and are fitted with gun-metal steps.

The plant is driven by a 250 brake horse-power English Electric protected-type slip-ring reversing induction motor, which runs at 365 revolutions per

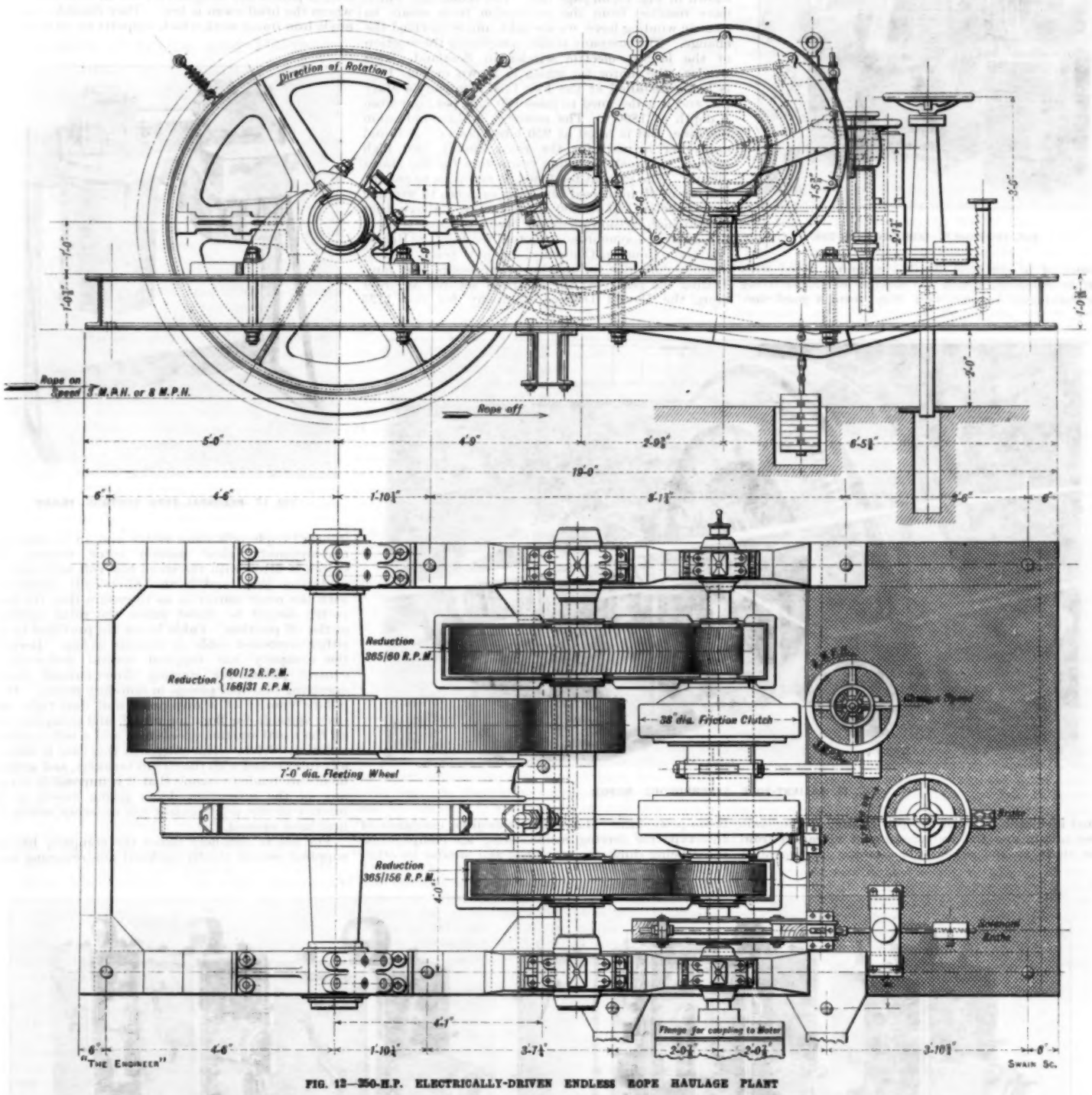


FIG. 12—250-H.P. ELECTRICALLY-DRIVEN ENDLESS ROPE HAULAGE PLANT

* No. I. appeared July 27th.

minute, and operates on a 3500-volt, 50-cycle, three-phase supply. The slip rings are enclosed in a flame and explosion-proof cover. The motor is connected to the first motion shaft of the haulage plant by

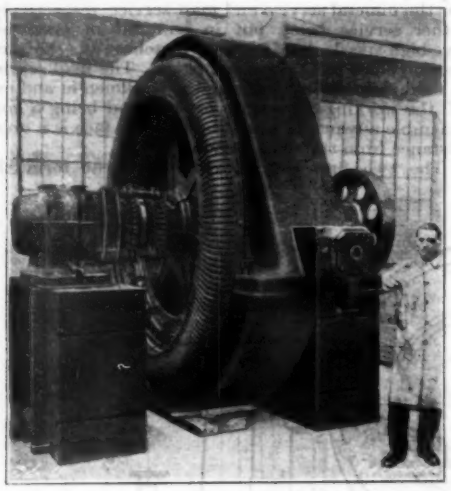


FIG. 13—950-H.P. INDUCTION MOTOR

means of a pin type flexible coupling fitted with leather cushions, which are capable of transmitting the maximum torque, and they form a good electrical insulator between the two shafts, at the same time minimising the transmission of vibration from one shaft to the other. The motor is controlled by an Allen, West reversing liquid controller, which is operated by a lever mounted on the frame and having a gate-change device. The whole of the plant, with the exception of the liquid reversing controller, is mounted on a strong steel box section bed-plate built up of rolled steel channels and joists, plated at the top and bottom.

Two Ward Leonard Ilgner winding equipments have been installed by the British Thomson-Houston Company at the Staveley "Do Well" collieries. High-speed contactor gear has replaced the liquid slip-ring regulator as usually employed. The equipment includes transformers and the makers' latest change-over switchgear, which gives a large number of combinations and ensures considerable flexibility. A view of the equipment is given in Fig. 18 on page 126. During the past year the company also supplied three geared alternating current winders to the Powell Duffryn Company, two of them being the largest in the country. One of these equipments is shown in Fig. 19, on page 126. The economies which have resulted from the conversion from steam to electric winding have, we are told, amply justified the change. The company is also completing the erection of the largest electric winder in Scotland. This winder—the motor for which is shown in Fig. 13—is being installed at the Fife Coal Company's Mary pit, and it is designed to raise 180 tons per hour from a depth of 1800ft. The motor is a three-induction machine, and is rated at 950 horse-power. A liquid controller is used for the rotor circuit, and high tension air-break reversing contactors for the stator circuit. The present tendency, it seems, is to confine the use of oil immersed reversing switches to winding motors below 440 or 500 horse-power. Above that output high-tension air-break contactor gear is used.

Salient pole synchronous motors, made by the British Thomson-Houston Company, are now being used at various collieries for driving compressors and fans. During the past year the company secured an order from the Powell Duffryn Company for two 1125 horse-power and 1125 kilovolt-ampère machines of this type for driving reciprocating air compressors, these being duplicate machines and similar to other machines supplied to the same company. These are claimed to be the largest motors of this type that have been used for driving air compressors in this country, and each machine supplies 675 kilovolt-ampères for power factor correction in addition to driving the compressor. A view of one of these motors is given in Fig. 14. Many other of these synchronous motors have been supplied by the company for driving air compressors, some working at unity power factor, others being used for power factor correction. The advantages of improving the power factor by means of these motors coupled to air compressors are, we are told, becoming more generally appreciated, although there are, it seems, still engineers who are afraid to adopt the synchronous motor, notwithstanding that a great many machines of that type are now in successful operation.

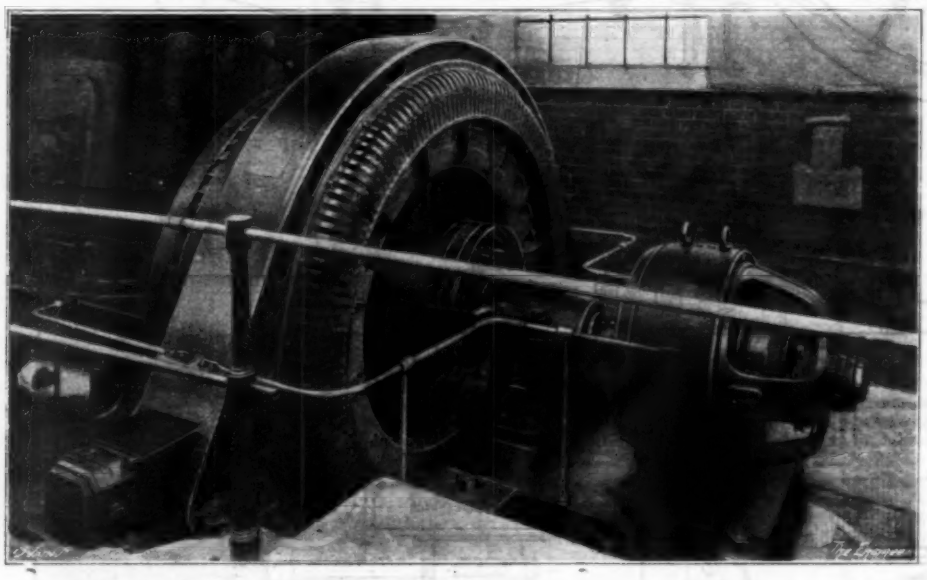


FIG. 14—SALIENT-POLE SYNCHRONOUS MOTOR

For use with moderate sized low-tension slip-ring motors the company has developed the pedestal type of control panel—as shown in Fig. 17. These switch panels are designed for use in non-fiery mines where the head room is low. They consist of a rigid angle iron frame work which supports an oil immersed

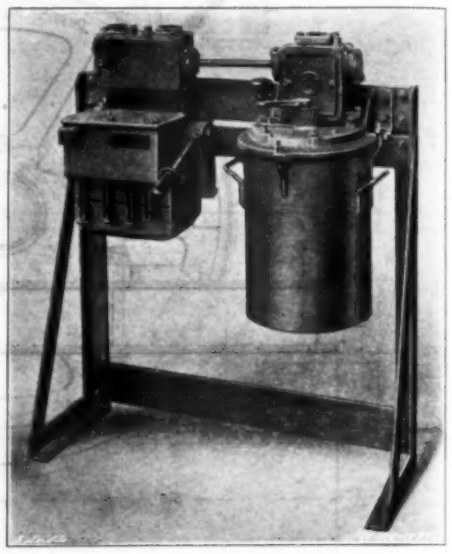
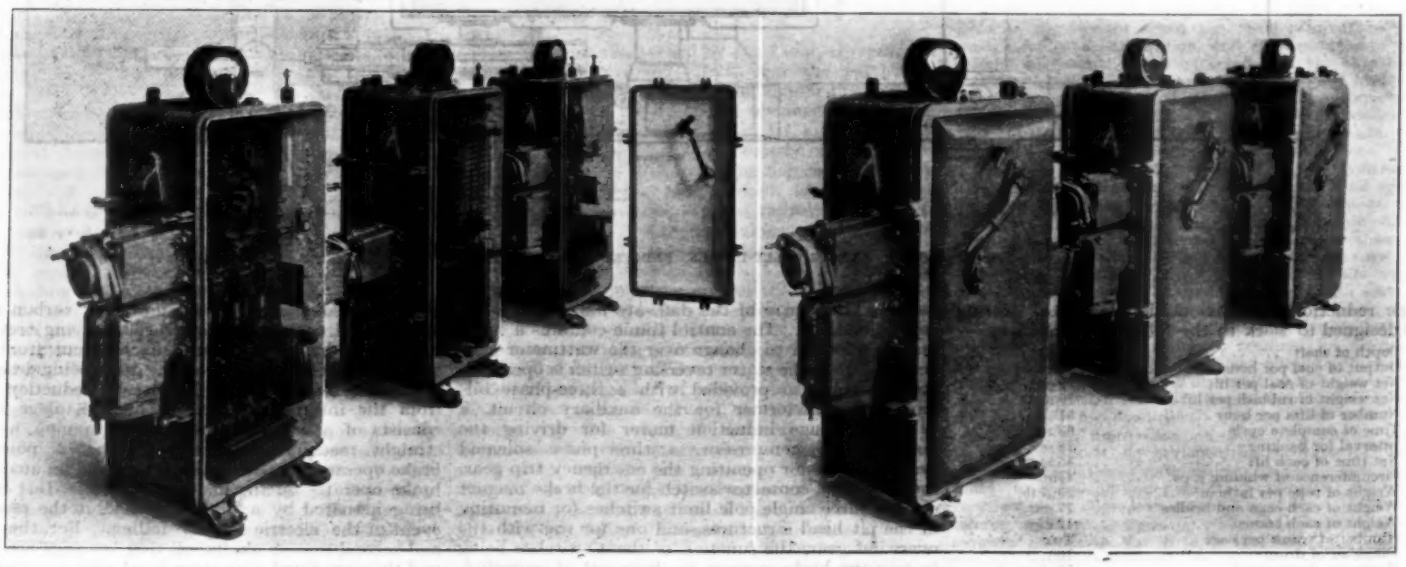


FIG. 17—PEDESTAL-TYPE CONTROL PLANT

ironclad triple pole main switch and an oil immersed non-automatic slow motion rotor starter. The switch is fitted with the usual low volt and overload protective gear, and is also electrically interlocked with the rotor starter so as to ensure that the main switch cannot be closed unless the rotor starter is in the off position. Cable boxes are provided to suit either armoured cable or conduit wiring. Recently the company has supplied several non-reversing control pillars for starting direct-current motors operating fans and pumps in non-fiery mines. These pillars consist of a drip-proof and dust-tight steel case, suitable for floor mounting, and equipped with all the usual starting accessories and a self-contained isolating switch. The starter in this case is electrically interlocked with the circuit breakers, and arrangements are made to ensure that it is impossible to open any of the inspection doors giving access to the interior of the pillar unless the isolating switch has first been opened.

For use in non-fiery mines the company has also supplied several totally-enclosed non-reversing starting pillars for use with slip-ring induction motors. These starting pillars—see Figs. 15 and 16—consist of a heavy-duty starter with renewable contacts, and electrically interlocked with a contactor type



FIGS. 15 AND 16—TOTALLY-ENCLOSED MOTOR STARTING PILLARS FOR NON-FIERY COLLIERIES

circuit-breaker, furnished with the necessary mica insulated grid type starting resistance, and with sheet steel cases fitted with cable boxes and an externally operating handle.

The company has designed three distinct types of drum controllers for mining service, all of which have frames intended for taking either pipe connections, or for clamping armoured cable. The controllers supplied are:—(*a*) A totally enclosed air-brake vertical drum type controller; (*b*) a totally enclosed ironclad watertight controller; and (*c*) a horizontal ironclad totally enclosed oil-immersed controller fitted with the usual operating lever and with a case having machine-faced joints between the box and cover.

Locomotive Practice and Performance in France.

By J. T. BURTON-ALEXANDER.

No. I.

THE more disastrous effects of the war have been overcome by the French railways with courage and rapidity, and the summer services of 1922 showed on most lines a return to more or less normal conditions, especially when it was borne in mind that the loads had increased enormously over those of pre-war times. I was enabled through the courtesy of the locomotive superintendents of the Midi, Paris-Orleans, Paris, Lyons and Mediterranean, and Northern of France railways to make various trips on the footplates of their engines during last summer and winter, in addition to other journeys made in the train itself.

The most convenient plan will be to take the railways as they come in the French time table, viz., State, Midi, P.O., P.L.M., and Nord.

The State Railway has very heavy trains, when the banks of 1 in 100 are taken into account on the Cherbourg line. Last summer, behind one of its big 4-6-2 compounds and a load of 420 tons behind the tender, in spite of blustering wind and rain squalls, we passed Asnières, 3.7 miles from St. Lazare, in 9 min. 15 sec., including three slows to a walking pace on account of permanent way operations; Achères, 13.6 miles, in 27 min. 20 sec., in spite of a further long dead slow at Bezons; Aubergenville, 28.5 miles, in 43 min. 20 sec.; Mantes Junction, 36 miles, in 50 min. 45 sec., at a walking pace for the Cherbourg line junction; Breval, 44 miles, in 70 min. 20 sec., the gradient from Mantes being 1 in 100; Bueil, 50.3 miles, in 76 min. 20 sec.; and stopped in Evreux, 67 miles, in 99 min. 10 sec. gross, or 91 min. net, deducting the permanent way delays, but nothing for the slow at Mantes, and having gained seven minutes on the booking. Starting smartly from Evreux, we passed La Bonneville, 6.2 miles, in 8 min. 40 sec.; Serquigny, 15.4 miles, in 23 min. 55 sec., at reduced speed; Bernay, 31.6 miles, in 41 min. 50 sec.; and stopped at Lisieux, 51.5 miles, one and a-half minutes early, in 67 min. 20 sec. Starting up a gradient of 1 in 100, we passed Mesnil Mauger, 11.1 miles, in 20 min. 40 sec.; Mezidon, 15.5 miles, in 25 min.; and stopped at Caen, 29.8 miles, in 41 min. 50 sec., exactly on time.

The new stock on the State Railway is most comfortable, and the running on both the Dieppe, Cherbourg and Brest sections is very smooth.

I made several other journeys on the State Railway, which showed excellent time-keeping with equally heavy loads, which confirms the work mentioned above.

On the Midi.

On the Midi Railway the schedules are as fast as before the war, the loads are much heavier, while time-keeping is excellent.

In August, 1922, with 3101, one of the new 4-6-2 two-cylinder superheater engines, of which there are twenty—3101-3120—and a load of ten coaches, or 390 tons behind the tender, we ran from Montauban to Toulouse, passing Montbartier, 7.4 miles, up 1 in 250, in 14 min.; Grisolles, 14.9 miles, in 22 min.; Lacourtensourt, 27.3 miles, in 36 min.; and stopped outside Toulouse Station, 31.5 miles, in 41 min., the maximum speed allowed since the war being 62.1 miles an hour.

On another occasion, No. 3111 and a load of nine coaches, or 365 tons, ran from Montauban, passing Montbartier in 13 min. 20 sec.; Grisolles, in 21 min. 40 sec.; Lacourtensourt, in 34 min. 30 sec.; and stopped in Toulouse Station in 40 min. 30 sec., in spite of a momentary stop just outside, which is obligatory, making up two minutes on the booked time.

On another occasion, with 3104 and a load of eleven coaches, 350 tons, but packed with passengers, we ran from Bram to Castelnaudary, 9.9 miles, on rising gradients of 1 in 330 and 1 in 200, in 13 min. 55 sec., start to stop; and, leaving there, passed Segala, 6.2 miles, in 10 min. 55 sec., mostly up 1 in 200; and stopped in Villefranche, 13.6 miles, in 19 min. 15 sec.

On the Limited Luchon and Font Romeu-Paris express, 3111 ran with seven coaches, 339 tons, from Toulouse to Montauban, 31.6 miles, in spite of a slow approach to the stop, in 35 min. 55 sec.

In December, 1922, in a violent gale and rainstorm, engine No. 3112, with a load of nineteen coaches weighing 395 tons and packed with passengers, on the one o'clock express from Bordeaux, after leaving that station, passed Begles, 1.8 miles, in 6 min. 45 sec.; Pedensac, 17.3 miles, in 25 min. 5 sec.; and stopped in the yard for signals at Langon, 26 miles, in 35 min. 10 sec., in spite of having been slowed for two minutes previously. Starting again from Langon Station, we stopped at La Reole, 11.7 miles, in 17 min. 29 sec. From there to Marmande, 11.1 miles, we took 17 min. 20 sec., losing seventy seconds on the booked time, but ran on to Tonneins, 10.5 miles, in 16 min. 50 sec.; gaining two minutes, and in spite of overstaying time at most of the stations, owing to the holiday traffic, were one minute before time at Toulouse. All these times were made without the driver knowing he was being timed.

On Christmas Eve, I was enabled to make the run on the footplate of the Bordeaux-Marseilles night Rapide, with engine No. 3114 and a load of fifteen coaches, or 410 tons behind the tender. The train was steam heated and the weather was frosty with mist, and the rails were slippery. The booking of this train is as fast as before the war, with a greatly increased load. We started slowly, owing to slipping, and passed Begles, 1.8 miles, in 5 min. 40 sec., at 31 m.p.h.; Langon, 26 miles, in 34 min. 10 sec., at the reduced speed of 37 m.p.h., speed having risen before that to 55.9 m.p.h. Recovering smartly, La Reole, 37.8 miles, was passed in 47 min. 25 sec., at 53 m.p.h.; and we were stopped for signals just before Marmande, in 57 min. 10 sec. After standing for 4 min. 15 sec. we re-started, and passed Marmande Station, 49 miles, in 62 min. 40 sec., deducting the time we were stopped, but at the speed of 18 m.p.h., owing to permanent way relaying. Tonneins, 59.6 miles, was passed in 76 min. 15 sec.; Porte Ste. Marie, 72 miles, in 89 min. 55 sec.; and we stopped at Agen, 84.4 miles, in 104 min. 35 sec., having lost 4 min. 35 sec. only, which was largely accounted for by the slippery rails, the signal stop and slow at Marmande. The speed ranged between 53 and 56 m.p.h., the admission was 35 to 40 per cent., the boiler pressure of 195 lb. was well maintained, and there was always more than half a gauge glass of water. One injector sufficed to maintain the water level, and the pressure in the steam chests varied from 150 lb. to 165 lb. per square inch. Starting again from Agen, the rails were very slippery, and we passed Bon Encontre, 3.1 miles, in 7 min. 30 sec., speed having risen to 45 m.p.h.; Valence d'Agen, 16.2 miles, in 21 min. 40 sec., speed having risen to 55 m.p.h.; Moissac, 26.1 miles, in 33 min. 10 sec., speed being reduced; Castelsarrasin, 31.5 miles, in 40 min., speed being reduced to 43.4 m.p.h. Montauban, 43.5 miles, was reached in 54 min., after an easy approach. The speed never fell below 51.2 m.p.h. up the 1 in 330 and 1 in 250 out of Castelsarrasin to the summit. From there we passed Montbartier, 7.4 miles, in 13 min., and stopped in the yard at Toulouse, 31.5 miles, for signals, in 41 min.

It must not be forgotten that the line follows the Garonne from Bordeaux to Moissac, with a rising tendency, and with coal of which he is not sure the driver is afraid to push, as there is nowhere where he can shut off if his pressure goes back on him. This was much superior to any work I have noted prior to the war. As there is no superheater gauge on this class of engines, I was unable to note the steam temperature. This train keeps excellent time, as does also the Day Rapide, which is often in Toulouse one or two minutes before time.

On the Day Rapide from Marseilles to Bordeaux I was enabled to make a run from Cette to Castelnaudary, on February 1st, in fine weather, but with a furious side gale, with 3116 and a load of eleven coaches, or 388 tons, behind the tender. This run is specially interesting, as the brick arch came down before Béziers, and the fireman had to re-make his fire at Narbonne.

Starting on time from Cette, we passed Les Onglous, 11.1 miles, in 16 min. 30 sec., at 45 m.p.h.; Agde, 14.9 miles, in 21 min. 20 sec.; and stopped at Béziers, 27.9 miles from the start, in 38 min. 10 sec., the gale having prevented our speed exceeding 50 m.p.h., in spite of 180 lb. pressure in the steam chest and 38 per cent. cut-off. From there we ran the 15.5 miles to Narbonne in 23 min. 10 sec., speed having risen to 42.3 m.p.h. on the 1 in 250 out of Béziers. From Narbonne starts the climb to the watershed beyond Castelnaudary, with gradients of 1 in 330 and 1 in 200. In spite of the excellent work of the fireman, our boiler pressure was only 180 lb. to the square inch and 150 lb. in the steam chest, but we kept a steady half tube of water to the top, with the variable exhaust less than half shut. We passed Marcorignan, 6.2 miles, in 11 min. 40 sec., speed having risen to 39.5 m.p.h.; Lézignan, 14.2 miles, in 22 min. 40 sec.; Moux, 21.2 miles, in 33 min. 20 sec.; Capendû, 26 miles, in 39 min. 25 sec., speed having risen to 45 m.p.h.; and stopped at Carcassonne, 36.6 miles, in 55 min. 50 sec., having regained 2 min. 10 sec. on booked time, in spite of the failure of the brick arch and the gale. Starting again, we passed Bram, 12.4 miles, in 19 min. 10 sec.; and stopped in Castelnaudary, 22.9 miles, in 32 min. 30 sec., having made up a further two and a-half minutes.

In the other direction, from Toulouse to Cette, with No. 3109 and a load of ten coaches, or 365 tons, in February, on a fine but windy day, the speed on the 1 in 200 out of Toulouse rose to 42.4 m.p.h. before we had to shut off for a long relaying slow to a mere walking pace; but we passed Escalquens, 8 miles, in 21 min. 50 sec. gross, at 40 m.p.h. A further slow to 12 m.p.h. delayed us still more, so that we only passed Baziège, 14.3 miles, in 32 min. 50 sec., at 41 m.p.h.; Villefranche, 20.6 miles, was passed in 40 min. 30 sec., at 50 m.p.h.; Segala, 27.9 miles, in 49 min. 15 sec., the speed not having dropped below 50 m.p.h.; the cut-off was 48 per cent., but though we had a full boiler of steam and water the pressure was only 150 lb. in the steam chest. Castelnaudary, 34.1 miles, was passed in 56 min. 50 sec., at the regulation reduced speed of 31 m.p.h.; Bram, 44.4 miles, in 68 min. 15 sec., speed having risen to 62.1 m.p.h.; and we reached Carcassonne, 55.5 miles, in 82 min. 30 sec. gross, or 68 min. 30 sec. net. From Carcassonne we felt the full effect of the gale, but passed Capendû, 10.5 miles, in 13 min. 55 sec., with a cut-off of 40 per cent. and 120 lb. pressure in the steam chest; Moux, 15.5 miles, in 19 min. 5 sec.; Lezignan, 22.3 miles, in 26 min. 5 sec.; Marcorignan, 30.4 miles, in 34 min. 40 sec.; and stopped in Narbonne, 36.6 miles, in 41 min. 45 sec., instead of 44 min. booked time. Narbonne to Béziers took 22 min. with a speed of 43 m.p.h. at the top of the bank at Colombiers, and the 27.9 miles to Cette, with a stop just outside the station, 35 min., the pressure in the steam chest being kept at 135 lb. per square inch.

My last two runs were on the Winter Express from Paris to Font Romeu, which is run as a special "rapide" from Toulouse to Villefranche-Vernet-les-Bains. The usual load is six coaches, but, unfortunately, the day I made the trip we only had five, weighing 200 tons. The engine was 3101 as far as Narbonne, and 3120 on to Perpignan, where the express running ceases; with such a load, even with a light fire, we had more steam and water than was best for fast running. We had the usual slow for relaying, but our speed had risen to 50 m.p.h. before we shut off, and we passed Escalquens in 18 min. 50 sec., after another slow to 12 m.p.h.; Baziège was passed in 28 min. 10 sec., at 50 m.p.h.; Villefranche, in 34 min. 40 sec., at 57.1 m.p.h.; Segala, in 42 min. 30 sec., at 55.8 m.p.h.; and Castelnaudary, in 50 min. 15 sec., at the regulation speed of 31 m.p.h.; the speed rose rapidly to 62.1 m.p.h., the maximum allowed up to Carcassonne; Bram was passed in 60 min. 20 sec.; and Carcassonne was reached in 74 min. 30 sec. gross, or 64 min. 30 sec. net. Starting smartly, we passed Capendû in 13 min. 40 sec., in spite of a signal slack, speed having risen to 63.3 m.p.h., the maximum speed allowed from Carcassonne being 71.4 m.p.h.; Moux, in 18 min. 20 sec., speed having dropped to 60.9 m.p.h.; Lezignan, 24 min. 35 sec., a maximum speed of 68.3 m.p.h. having been reached; Marcorignan, in 32 min. 15 sec.; and stopped in Narbonne in 39 min. gross, or 38 min. net. The pressure in the steam chest was 150 lb. per square inch and the cut-off 35 per cent. The engine was exceedingly steady, even running at the maximum speeds, as were others of her class, though to a lesser degree. From Narbonne the line follows the main line for three-quarters of a mile to the junction for Cerbère, where a slack occurs; but we passed La Nouvelle, 13.6 miles, in 15 min. 10 sec., speed having risen to 63.3 m.p.h.; Fitou, 22.9 miles, in 24 min.; Rivesaltes, 34.7 miles, in 35 min. 50 sec., speed ranging between 63.3 m.p.h., the maximum, and 58.3 m.p.h.; and we stopped in Perpignan, 39.7 miles, in 41 min. 50 sec., in spite of a permanent way slow on the bridge before the station, which cost us quite thirty seconds, leaving a net time of 41 min. 20 sec. The boiler was full of water, the pressure in the steam chest was 165 lb. per square inch, and the cut-off 35 per cent.—excellent work, even with the light load, considering our maximum speed. Not allowing anything for our delays *en route*, we had gained 1 min. 40 sec. from Toulouse to Perpignan, on a booked running speed of 50.3 m.p.h.

The return journey is timed slower, as the train is allowed fifty-four minutes from Perpignan to Narbonne; however, the start was four and a-half minutes late. We passed Rivesaltes, 4.9 miles, in 8 min., at 57.1 m.p.h.; La Nouvelle, 26 miles, in 29 min. 45 sec., the speed having been kept down to a maximum of 60.8 m.p.h. After this we eased off, and in spite of a long slack by the engine sheds at Narbonne, reached that station, 39.7 miles, in 47 min., two and a-half minutes early, with engine No. 3101 and the same load as in the morning. From Narbonne, with engine No. 3120, we passed Marcorignan in 11 min. 10 sec., at 50 m.p.h.; Lezignan, in 20 min. 50 sec., with a maximum speed of 54.8 m.p.h.; Capendû, in 35 min. 55 sec.; and stopped in Carcassonne, in 53 min. 55 sec., three minutes early, in spite of having reduced speed from Lezignan. The boiler was full of water and the pressure was constantly at blowing-off point, although the dampers were shut. From Carcassonne the booking is easy; the Paris train only leaves Toulouse at 8.23, and as this departure cannot be altered it is timed to arrive at Toulouse at 7.54, allowing 82 min. from Carcassonne; however, the delays just before Toulouse make it hard to keep time. From Carcassonne we passed Castelnaudary in 32 min. 35 sec., speed being reduced; Villefranche, in 49 min. 40 sec., speed being allowed to fall to 50 m.p.h., though it had risen to 58.9 m.p.h. at Segala, the top of the bank; we had the two permanent way

slows, which were faithfully observed, and stopped in Toulouse yard in 82 min. gross, stopping in the station in 83 min. 35 sec., exactly on time. After our final slow our speed rose to 50 m.p.h. before the driver shut off for the Toulouse stop.

In each case the train was steam heated, which takes, according to the French railway companies, 10 per cent. of the boiler steam.

These examples will show what the Midi Railway is doing, and from many observations of the arrival of these trains at Toulouse I can say that the standard of punctuality is very high. The company is fast relaying its main lines and putting them into first-rate order. The work done is superior to what I noted before the war on the Bordeaux-Cette line.

To give an example of the 1914 loads on the night Bordeaux-Marseilles Rapide in April of that year with engine No. 1925, a 4–4–2 compound, and ten coaches, 219 tons, we left Bordeaux and passed Langon in 33 min., at a reduced speed of 43 m.p.h., speed having risen to 62.1 m.p.h.; Marmande, in 59 min. 10 sec., at a speed of 53 m.p.h.; and stopped in Agen in 99 min. 40 sec., without any delays. Changing engines for No. 3509, a 4–6–0, we passed Bon Encontre in 8 min. 5 sec.; Valence D'Agen, in 20 min.; Moissac, in 31 min. 55 sec., at a reduced speed of 47 m.p.h.; and stopped in Montauban, in 50 min. 15 sec. From there, Montbartier was passed in 10 min. 30 sec., but signal slows and relaying spoilt the run on. On the 9.8 a.m. Rapide from Toulouse, engine No. 1905, a 4–4–2, with a light load of seven coaches, or 150 tons, we ran to Toulouse from Montauban in 37 min. 5 sec., with one long permanent way slow to 5 m.p.h.; but the maximum speed allowed then was 71.4 m.p.h., a net time of 34 min. 30 sec., and on to Agen in 49 min., reaching there one minute early.

On the Paris-Orleans.

On the Paris-Orleans Railway I have had numerous examples of post-war work, on both the Paris-Toulouse and Paris-Bordeaux lines. Loads are much increased and the maximum speed of 49.6 m.p.h. is in force from Limoges to Montauban, instead of 59 m.p.h. as before the war. This is a great handicap on a line whose ruling gradient is 1 in 100. On the Bordeaux line the maximum speed has not been reduced, but it is very rare to exceed 65 m.p.h.

In the summer of 1922, on the 7.57 p.m. Toulouse express from Paris Orsay, and no less a load than 501 tons, in spite of its being the second portion, I was enabled to take certain times from the carriage. With engine 3548, a 4–6–2 compound, we passed Etampes, 34.1 miles, in 42 min. 35 sec., and were stopped in the yard at Les Aubrais, 72.6 miles, in 92 min. 40 sec. After starting again from Les Aubrais, we were stopped by signals at Vouzon, 19.9 miles, in 25 min. 30 sec. From Issoudun to Chateroux, instead of a booked time of 26 min. for the 16.7 miles, we took 23 min. 50 sec., and from Chateroux on, with No. 4583, and the same load, we passed Argenton, 19.2 miles, in 25 min. 59 sec. The signal delays are easily explained when it is remembered that we were the fourth train out of Paris between 7.30 and 7.57 p.m. These times were taken without anyone knowing any timing was being made, and in holiday time.

Before the end of the summer season I was enabled to make a run on the new Luchon-Font Romeu express from Montauban to Paris. Owing to previous delays we were considerably behind time; the weather was misty and cool and caused at times slipping. The load was seven coaches, 339 tons, and engine 4554. After a slow start we passed Fonneuve, 4.9 miles, in 10 min. 40 sec., speed having risen to 45 m.p.h.; Caussade, 14.9 miles, in 22 min. 45 sec., having touched 49 m.p.h.; Montpezat, 23.6 miles, in 35 min. 10 sec., at 40 m.p.h., the 1 in 100 being climbed with 45 lb. steam pressure in the low-pressure cylinders and a cut-off of 60 and 70 per cent. in the high-pressure and low-pressure cylinders respectively; and we stopped at Cahors, 39.7 miles, in 58 min. 20 sec., in spite of a permanent way slow, which lost one and a-half minutes, leaving a net time of 56 min. 50 sec.

From Cahors to Brive the weather was worse and the slipping bad; in fact, on the bank from Souillac to Gignac our speed fell to 18 m.p.h., so that we took for the 62.1 miles 97 min. 45 sec., or only one-quarter of a minute less than booked time.

At Brive we had engine No. 4529, and I must congratulate the crew on the way it worked. Donzenac, 7.4 miles, was passed in 12 min. 15 sec.; Vigeois, 19.2 miles, in 30 min. 45 sec.; Uzerche, 24.9 miles, in 38 min. 20 sec., where we had to shut off owing to the distant signal being "on," so losing speed; La Porcherie, 37.4 miles, in 54 min. 20 sec., the speed at the top of the long bank being 39.7 m.p.h., and the pressure in the low-pressure cylinders was 30 lb. per square inch; Pierre Buffière, 48.4 miles, in 70 min. 55 sec.; and we stopped in Limoges, 61.4 miles, in 90 min., after being slowed for the Perigueux Junction three minutes outside. From Vierzon the load was increased by a diner, making eight coaches, 376 tons, and with engine 3550, we passed Salbris, 13.6 miles, in 18 min. 15 sec., in spite of a slow in the yard at the start; Lamotte, 25.5 miles, in 30 min. 40 sec.; La Ferté, 35.4 miles, in 40 min. 50 sec.; and stopped at Les Aubrais, 49 miles, in 57 min., or a net time of 56 min., without exceeding the maximum speed of 62.1 m.p.h. Starting again, we passed Cercottes, 4.3 miles, in 8 min.; Toury, 18.6 miles, in 23 min. 5 sec.; Etampes, 36.6 miles, in 43 min. 45 sec.; Bretigny, 51.5 miles, in 59 min. 10 sec., with a long permanent way slow just after for three and a-half minutes; Juvisy, 59.6 miles, in 72 min. 35 sec.; and stopped in Paris-Austerlitz, 73.2 miles, in 86 min. 25 sec. gross, or 83 min. net, having regained twenty and a-half minutes from Vierzon.

In November, on a bitterly cold clear night, on the 9.30 Barcelona express, with a load of eleven coaches, 408 tons, and engine 3541, from Paris-Austerlitz, we passed Etampes in 48 min. 30 sec., in spite of a long relaying slow thirteen minutes after the start, and stopped at Les Aubrais in 97 min. 10 sec. gross, or 94 min. net; starting from there we passed Vouzon in 24 min. 50 sec.; Theillay, 43.4 miles, in 58 min. 50 sec., dead slow from signals; and stopped in Vierzon in 71 min. 15 sec. gross, or 66 min. net. From there we passed Issoudun dead slow for a bridge renewal, in 33 min. 5 sec., and stopped in Chateauroux, 39.1 miles, in 55 min. 30 sec. gross, or 52 min. net, a saving of four and a-half minutes on the booked time.

From Chateauroux the engine was 4586 with the same load. We passed Luant, 8 miles, in 12 min. 55 sec., dead slow for relaying; Argenton, 19.1 miles, in 29 min. 35 sec.; Celon, 25.6 miles, in 41 min. 15 sec.; St. Sebastien, 36.6 miles, in 58 min. 55 sec.; La Souterraine, 48.4 miles, in 77 min. 20 sec., again a long dead slow, at 3.6 m.p.h.; St. Sulpice, 64.6 miles, in 87 min. 45 sec.; and stopped in Limoges, 85 miles, in 122 min. 15 sec. gross, or 115 min. net. On the climb from Argenton, 1 in 100, our boiler pressure was steady at 225 lb. per square inch, and the pressure in the low-pressure cylinders was 45 lb., speed varying between 31 and 41 m.p.h. The driver, owing to the steam heating of the train—75 lb. pressure from the boiler, reduced to 30 lb. in the pipes—and the hard run, was afraid of his water, but had just enough to get to Limoges. It was a fine effort with a train of such a load on such gradients and curves. With engine 4554 and a load of nine coaches, 354 tons, from Cahors, we passed Lalbenque, up 1 in 100, 11.1 miles, in 21 min. 10 sec.; Caussade, 24.8 miles, in 38 min. 30 sec., in spite of a slow to 18 m.p.h., and stopped in Montauban, 39.7 miles, in 57 min. 5 sec. gross, or 54 min. 35 sec. net.

It must not be forgotten that all these runs were made by engines in service before and during the war; that the coal is not up to pre-war standard; and that the maximum speed from Limoges to Montauban has been reduced by 9.3 m.p.h., a very great handicap for climbing banks of 1 in 100, often 10 miles long; and in no case, even when I was on the footplate, was any previous notice given of my presence. I have seen trains leave Paris for Toulouse with loads of fourteen and fifteen coaches, or 550 tons, which were taken by one engine as far as Limoges.

The P.O. are now using, on the Brive-Toulouse line *viâ* Capdenac, some very fine post-war 2–8.2 simple superheater engines, built in America. I hope this summer to see more of their work on banks of 1 in 75 with loads of 350 and 400 tons.

Some trials are being made at the Northfleet Paper Mills, Kent, with a new process for utilising straw and esparto grass for paper making. It is hoped that the scheme may provide a profitable outlet for the great quantities of straw produced by the Prairie Provinces of Canada.

"Clyde Marine Oil Engines."*

By Dr. A. L. Mellanby, Member of Council.

The application of the heavy oil engine to ship propulsion involves problems which can only be dealt with in a satisfactory fashion when a wide experience of marine conditions is available, and the recent rapid progress in the development of marine oil engines dates from the time when their manufacture was taken up in centres which already had an extended experience of the earlier steam installations. While the large sizes called for by present-day requirements must involve the use of heavy production plant and, in a measure, place firms with such plant in a favourable position, it is becoming more apparent that the use of the oil engine as the primary power introduces a series of special problems which only those with marine experience are in a position to solve. Thus the absence of boiler plant makes it necessary to review the cargo handling plant, steering gear, ship's heating and other services; while the oil engine itself makes use of a number of auxiliary pumps and fittings, all of which must meet the requirements of marine conditions, not the least important of which is absolute reliability.

During the period when oil engine manufacturers tendered for the main engine alone, there remained a number of smaller parts, amounting to about 30 per cent. of the engine value, for which the marine engine firms were best fitted to take responsibility. It was, however, only natural, that the tendency should be towards a unification of the interests involved, and the initial experience of those intimately connected with the development stage of the oil engine being available by alliance or licence, the marine engineering firms now deal with the whole installation. The engines passing into service at the present time must be regarded as forming the first phase of the application of the oil engine to sea conditions, and are, therefore, of standard design, except where necessary modifications have been made to suit particular circumstances. With installations of this type coming into use in a routine manner—as a result of the confidence gained by this experience—the marine engineers' appreciation of the importance of higher powers, combined with the relatively reduced bulk and weight, is leading to developments of less orthodox designs, in which, largely by the adoption of the double-acting principle, better use is made of the mass of the material involved.

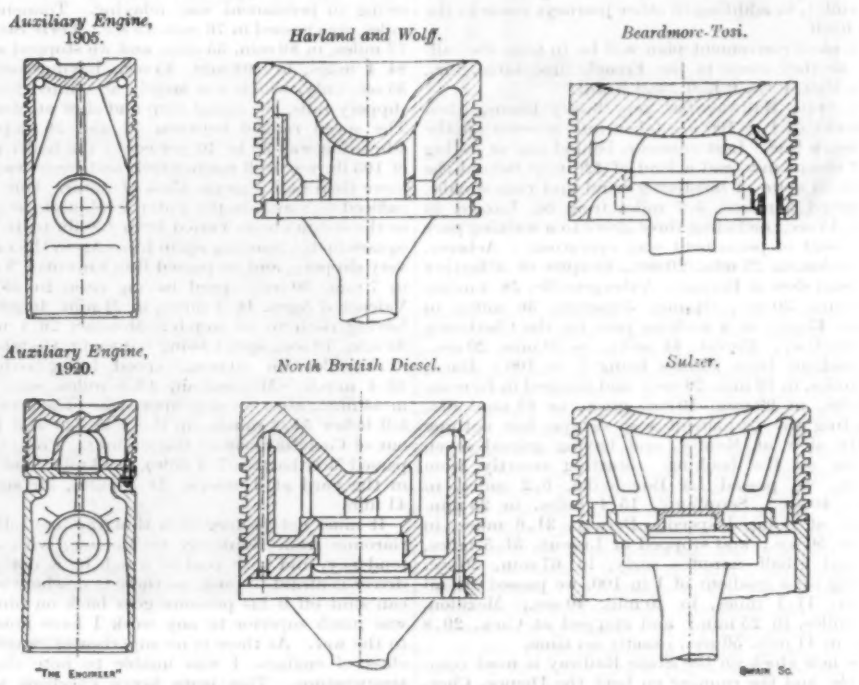


FIG. 1—SECTIONS OF OIL ENGINE PISTONS

In the sections of the paper which follow the author deals with the effect of tonnage regulations, the problems of lubrication, and questions relating to starting and manœuvring

Dealing with power rating a curve is reproduced which shows the connection between the oxygen remaining in the cylinder after combustion and the mean effective pressure in the cylinder. The slope of the curve shows that as the oxygen content of the gases is reduced the rate of increase of mean effective pressure diminishes. By producing the curve, it is suggested that a limiting mean effective pressure of about 140 lb. per square inch would be associated with complete combustion of the oxygen. It is suggested that trials showing mean effective pressures in the cylinder of values approaching to these should be received with suspicion, unless a definite system of supercharging is in use. Experience points to a practical value of about 125 lb. per square inch for an overload, and as on shipboard the usual figure on trial is about 100 lb. per square inch it can be seen that the margin is about 25 per cent.

Clyde Engines.—The trend of local practice is brought out in the Table I., where the important characteristics of each engine have been brought together. The popular engine would still appear to operate with air injection, by means of a fuel valve with hand control over the duration of injection. Thus, there is little sign that the mechanical injection principle is gaining ground, although there must be every inducement to eliminate the continuous operation of the blast air compressor, providing no counteracting

* Institution of Mechanical Engineers—Summer Meeting 1923.—Abstract.

disadvantages were involved. Marine practice has, in the past, made large use of built-up crank shafts, and the preponderance of solid forged shafts shown in the table may be looked upon as merely a passing phase. It is dictated by the interaction of present-day practice in piston and rotational speeds with Lloyd's rules for shaft sizes, the effect of which is to leave little material to carry the shrink stresses between the shaft and webs. In four-stroke cycle engines the Clyde builders have avoided the use of water cooling in the exhaust valve head, although this cooling is not unknown in other districts. The material for the valve head receives special consideration, and this, combined with thorough cooling of the valve seat, is found to satisfy present-day requirements. Here the specially favourable conditions arising from the use of the combined exhaust inlet valves in the Beardmore-Tosi engine deserve attention. These valves remain off their seats from the commencement of exhaust until the completion of induction, and hence, any carbon gathered during the earlier period is burnt off again by the incoming air so that the valve is always found perfectly clean. In addition, the incoming air cools the valve head to such an extent that regrinding is almost unnecessary. In consequence it has been found satisfactory to dispense with the usual valve cage and to make the valve seat directly on the cylinder head casting.

With the exception of the Scott-Still engine, all those tabulated have the cylinder liners cast separately of simple cylindrical form. Usually the liner is located at its upper end and free to expand downwards, while the explosion loads are taken through the cylinder jacket. The cylinder head of the four-stroke cycle engine is still a somewhat complicated casting, but this has not prevented the North British Diesel Engine Works from recessing the under surface and thus gaining room to accommodate larger valves. On service this design has proved very satisfactory. In the two-stroke cycle engines the increased value of the heat stresses has resulted in the disappearance of the valve-in-head scavenging arrangement, and the symmetry of the current Sulzer design must give favourable conditions in that part.

While the pistons are comparatively simple and symmetrical castings, they are at a disadvantage due to the fact that the cooling medium has to reach them through the telescopic pipe system. Here it is the upper surface which requires to be in contact with the cooling fluid, and this is, unfortunately, the part at which any air in the system will lodge. That much can be done through progressive design to ease the conditions is indicated by Fig. 1. The final form in which the load is carried at an intermediate diameter is probably the most definite step in recent progress towards larger units. From the preceding remarks it will have been gathered that, at the present time, a large variety of types of the marine Diesel engine are being constructed on the Clyde. The standard four-stroke cycle air injection engines are being made by Wm. Beardmore and Co., Limited, of Dalmuir, who are manufacturing the "Beardmore-Tosi" type; Harland and Wolff, Limited, and J. G. Kincaid, who have adopted the Burmeister and Wain system; and the North British Diesel Engine Works, who are developing the single-acting air-injection engine of their own design. There are also strong supporters of the two-stroke cycle principle. Of the firms building this type of engine there are Scott's Shipbuilding and Engineering Company, Limited, with the Scott-Still engine; Wm. Denny and Brothers; A. Stephen and Sons, Limited; Fairfield Shipbuilding and Engineering Company, Limited, with Sulzer licences; John Brown and Co., Limited; David Rowan and Co., Limited; Dunsmuir and Jackson, Limited, with the Fullagar engine developed by Cammell Laird and Co., Limited, of Birkenhead; and the North British Diesel Engine Company, Limited, with the double-acting engine of their own design. As with the exception of the last-named engine, all the other types have already been described in THE ENGINEER. We conclude this abstract with the brief description of the double-acting two-stroke cycle engine, which is being built at Whiteinch.

TABLE I.

	Four-stroke cycle.			Two-stroke cycle			
Design	Burmeister and Wain	North British Diesel Engine Works, Ltd.	Beardmore-Tosi	Sulzer	North British Diesel Engine Works, Ltd.	Scott-Still	Cammell-Laird-Fullagar
Clyde builders	Messrs. Harland and Wolff and Kincaid	North British Diesel Engine Works, Ltd.	Messrs. Beardmore	Messrs. Brown, Denny, Fairfield, Stephen, Weir	North British Diesel Engine Works, Ltd.	Messrs. Scott	Messrs. Brown, Rowan, Dunsmuir
Fuel injection	Air	Air	Air	Air	Air	Mechan'l automatic	Air
Fuel duration control	When required	No	Yes	Yes	Yes	Yes—automatic	Yes
Crank shaft	Various	Built	Solid forged	Solid forged	Semi-built	Semi-built	Solid forged
Crank case lubrication	Forced	Forced	Forced	Forced	Forced	Forced	Forced
Cylinder lubrication clear of crank case	Yes	Yes	Yes	No.	Yes	Yes	No
Explosion loads through	Steel tie bolts	Steel tie bolts	Cast iron columns	Cast iron columns	Cast iron columns	Cast iron columns	Working parts only (steel)
Piston cooling medium	Fresh water or oil	Salt water	Fresh water	Salt water	Fresh water	Steam	Fresh water
Piston cooling pipes	Telescopic	Jet system	Jet system	Jet system	Telescopic	None	Telescopic
Piston cooling pressure, lb. per sq. in.	10–15	38	18	30	30	—	30
Manœuvring servo-motor	Air or electric	Air	Electric	Air	Hand	Hand or oil	Air
Starting air pressure, lb. per sq. in.	350	350	500	1000 at bottles	350	Steam—150	400
Blast air pressure, lb. per sq. in.	850–900	1000	1000	800–1000	900	—	1000
Air compressor stages	Three—differential	Three—differential	Three—differential	Three—differential	Three—differential	—	Four—differential
Thrust block	Michell	Michell	Michell	Michell	Michell	Michell	Multi-collar
Crosshead slipper	Single or double	Single	Single	Four faces	Single	Four faces	Double, and with side faces
Cam shaft drive	Spur	Skew	Skew	Skew	None	None	Skew and bevel
Fly-wheel	Aft or forward	Aft	Aft	Aft	Turning wheel only	Aft	None

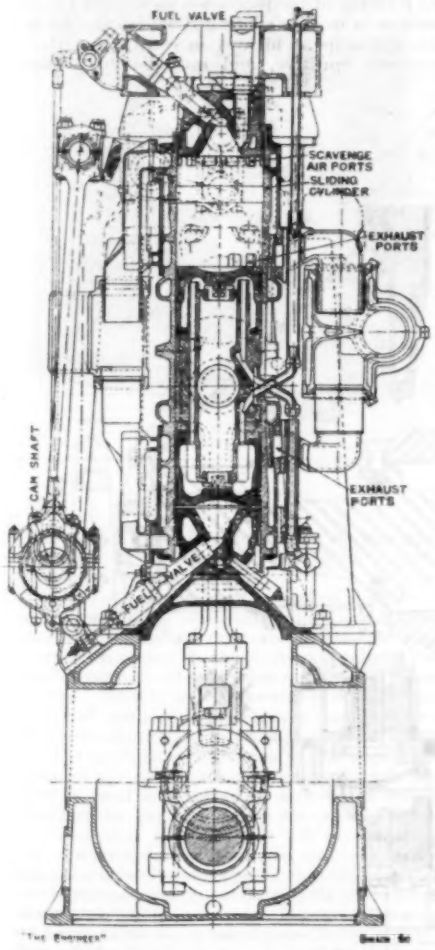


FIG. 2—NORTH-BRITISH DOUBLE-ACTING ENGINE

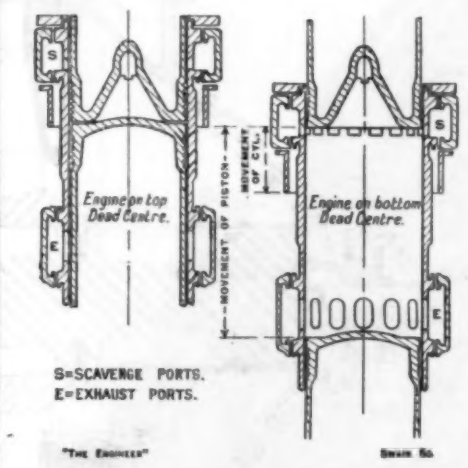


FIG. 3—DOUBLE-ACTING TWO-STROKE ENGINE

DOUBLE-ACTING ENGINES.

The general features of this engine may be gathered from Fig. 2, which represents an experimental unit which has now been put into service. The main feature of this engine is the open ended cylinder, which is free to reciprocate relatively to the two fixed covers provided at the top and bottom of the cylinder. These covers are fitted with spring rings so that a gas-tight joint is thus provided at each end along with freedom of axial motion. A double-acting piston reciprocates in the cylinder between the two fixed covers as shown. The absence of the usual piston-rod should be noted, as also the method of driving the crank shaft through a connecting-rod coupled to a gudgeon pin. This gudgeon pin is attached to the piston and the ends project through axial slots provided in the walls of the cylinder. Crosshead guides on each end of the gudgeon pin serve to take up the side thrust introduced by the connecting-rod.

The up-and-down motion of the cylinder is caused by the connecting-rod and levers shown to the left of the illustration, and these, in their turn, receive motion from a crank attached to the cam shaft shown. The air scavenge ports at the top and bottom of the liner are uncovered by the relative movement of the cylinder to the fixed covers. The exhaust ports are uncovered by the relative movement of the piston to the cylinder. The relative movements of the cylinder and piston are best shown in Fig. 3, from which the comparatively small amount of motion given to the cylinder will be observed.

Many advantages are claimed for this type of engine. The elimination of the piston-rod sweeps away many of the difficulties attached to the promotion of efficient combustion on the lower side of the piston. The simple form in which both the cylinder covers and the cylinder itself can be made reduces the possibilities of heat stresses, and the reduction in the relative velocity of the piston and cylinder will be favourable to the life of the piston rings. There will also be a great reduction in size and weight of engine, and the makers estimate that a four-cylinder engine of this type will give the same power as twelve single-acting four-stroke cycle cylinders of the same diameter and stroke. The trials with this experimental engine proved so favourable that it was decided to proceed with the building of a large engine of similar design. This engine has three working cylinders, 24½in. diameter with a stroke of 44in., and is anticipated to give a sea service about 2000 brake horse-power at 100 revolutions per minute, and it is now in an advanced stage of construction.

While it may be taken that war conditions interfered with the development of the Diesel engine in Britain, it will be acknowledged that within recent times an amount of enterprise has been shown both by shipowners and engineers which should go far to place this country in a position in which we can take some pride. The policy of constructing and using so many types is certain to lead to a favourable position from the point of view of actual experience, and its boldness is to be commended.

OPTICAL ENGINEERING AND APPLIED OPTICS.

ONE of the many difficulties which confronted this country at the beginning of the war, arose from the fact that, as a nation prior to that date, Great Britain had depended largely upon Germany for supplies of optical glass; and that British optical manufacturers had had practically no experience in the mass production of optical munitions of war.

To remedy this state of affairs and so far as possible to make a recurrence impossible, the Government, in the year 1917, acting through the Board of Education and the Department of Scientific and Industrial Research in conjunction with the London County Council and the Governors of the Imperial College, established at the Imperial College for a period of five years in the first instance, a Department of Optical Engineering and Applied Optics, under the general control of a committee representative of the various Government Departments concerned; the scientific societies and trade organisations; with the Right Hon. Sir Arthur Acland as chairman. This Department was placed in the charge of Professor Cheshire as Director, who, with the late Mr. Esslemont, had been responsible for the creation and administration of the Optical Munition Department of the Ministry of Munitions.

As the Department was originally sanctioned for five years only, the question of its future recently came up for consideration, and all those interested in the development and rehabilitation of this national industry will be glad to know that optical engineering and applied optics has now been put upon the same basis as regards permanency as the other Departments of the College. The Department is doing good work. The associateship of the Royal College of Science has been awarded to those students who have successfully completed the prescribed course of training, and past students are now beginning to make their influence felt in the optical world. Recognising, however, the pioneer character of the work to be done, all the lecture courses have been thrown open. Thus, except in the case of associateship students, any single lecture course can be taken without any obligation being incurred to attend other courses.

In this way a considerable number of students have been dealt with, and it is perhaps not too much to assume already that optical manufacturers in this country will never again find themselves in the unhappy position of 1914, when the production of munitions was severely hampered by the insufficient number of optical experts available both for the scientific direction of production and also for the designing and computing of large numbers of new optical systems demanded by the Government, from the simplest trench periscope, on the one hand, to complicated rangefinders required by submarines on the other.

GYROSCOPIC SHIP STABILISER FOR THE ADMIRALTY, ON THE TEST BED

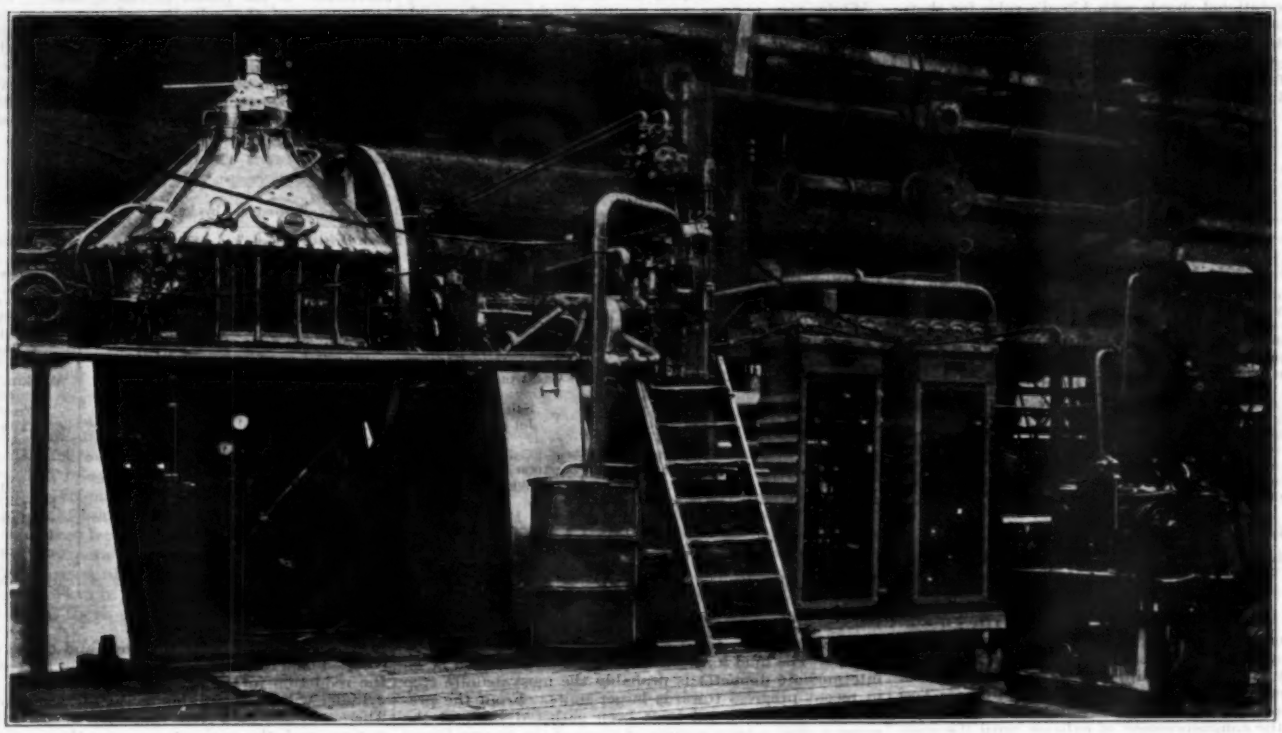


FIG. 1

The "Sperigyro" Ship Stabiliser.

In a brief note which appeared in our issue of June 22nd reference was made to the renewed attention which has recently been paid to the problem of preventing the rolling of ships in rough water. The subject of the stabilising of ships is, naturally, of interest to all who suffer from the discomforts of sea travel, but it is also a matter of technical importance to the naval architect and engineer, and it is chiefly with that aspect of the problem and some of the means which have been adopted for its solution, that we propose to deal in the present instance.

Ship stabilisers have been built in America by the Westinghouse Company to the designs of the Sperry Gyroscope Company, Limited, and have been supplied to the United States Navy and also to a Japanese naval vessel for purposes of experiment. The results of the experiments which have already been made have received the close attention of the British Admiralty, and we are now enabled to describe an installation for a British naval vessel—the first equipment of its kind to be built in Great Britain—which has recently been completed and tested at the Trafford Park Works of the Metropolitan-Vickers Electrical Company, Limited, where it was constructed to the patented designs of the Sperry Gyroscope Company, Limited, of 15, Victoria-street, London. The equipment, which has now been delivered to the Admiralty, is designed to limit the roll of the ship for which it is intended, under practically all conditions, to about 2 degrees either side of the vertical plane.

Some Advantages and Working Principles.

The advantages of a steady platform for the training and firing of guns and the launching of torpedoes from a fighting ship will be readily appreciated, and with the advent of the aircraft-carrying vessel, such a quality is of undoubted value in connection with the safe landing on and taking off from the ship's deck. Free rolling has also a very unfavourable effect in that it causes severe stresses in the structure of the ship, and in all the heavy parts of the machinery and equipment. Not only may serious damage result from such stresses, but in heavy weather the speed of the craft and the accuracy of steering is interfered with. This is specially noticeable in the case of combined rolling and pitching resulting in a "yaw." Under such circumstances the steering machinery is in continuous operation, and apart from the expenditure of steam used in the steering engine itself, the main propelling machinery is affected by the braking action which is caused by the repeated movement of the rudder through comparatively large angles.

According to experiments which have recently been made, it is stated that a vessel requires about 1 per cent. additional propelling power for every degree of roll, such increased power being necessary to maintain the same speed as would be given in a smooth sea. A further advantage of the stabilised vessel is that the bilge keels may be entirely dispensed with, giving improved propulsive efficiency.

The factors which have to be taken into account in designing a stabiliser are displacement, metacentric height, period of roll and roll increment; and its roll quenching power depends on the characteristic product of displacement, multiplied by period, multiplied by metacentric height. For full stabilisation the roll quenching ability of the stabiliser must equal the maximum roll increment.

The complete equipment is shown in the view—Fig. 1—reproduced above. A main gyroscope, shown to the left of the illustration, is placed in the vessel in such a position that its motor-driven rotor disc spins with its axis in the vertical fore and aft plane of the ship. The revolving disc and the bearings on which it is supported and turns are housed in a cast steel casing fitted with horizontal trunnions, and the manner in which the casing is supported allows the whole gyrostatic element to be moved about the horizontal athwartship axis. Such inclination in either fore and aft direction is given by the precession motor, which, through gearing, transmits motion to the vertical segmental ring attached to the main gyro casing. The rotation of the precession motor and its sense of direction is in turn controlled electrically by a small pilot gyroscope, which is so constructed that it is extremely sensitive, and immediately responds to any movement of the ship in the rolling plane.

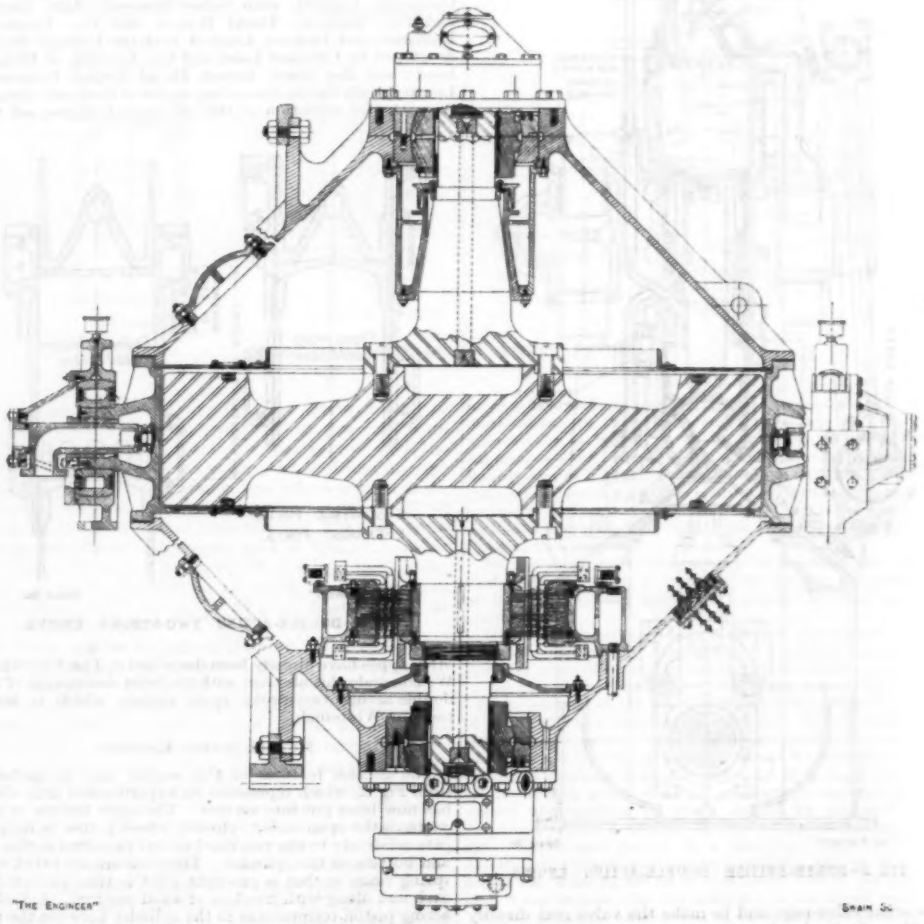


FIG. 2—SECTION THROUGH GYROSCOPE

The stabiliser performs its work by applying to the ship's structure a counteracting force sufficient in magnitude to neutralise the impulse of each wave received by the vessel. By such means the ship is prevented from accumulating any roll and its movement may be confined within predetermined limits. As previously mentioned, the movement of the ship

is first picked up by the small control or pilot gyroscope—a view of which we reproduce in Fig. 4. From this illustration it will be noted that the gyroscope is furnished with electrical contacts at one end of its axle, and as the rotor disc spins with its axis horizontal and athwartships, its mounting is such that when the vessel begins to roll either to port or to starboard, one or other of these contacts is closed. The closing of a circuit immediately sets the precession motor in operation, and inclines the casing of the main gyroscope in a direction either from aft to forward or *vice versâ*, corresponding to the contact closed by the control gyroscope. When the main gyroscope is in operation such movement applies a couple to the structure of the ship through the horizontal case

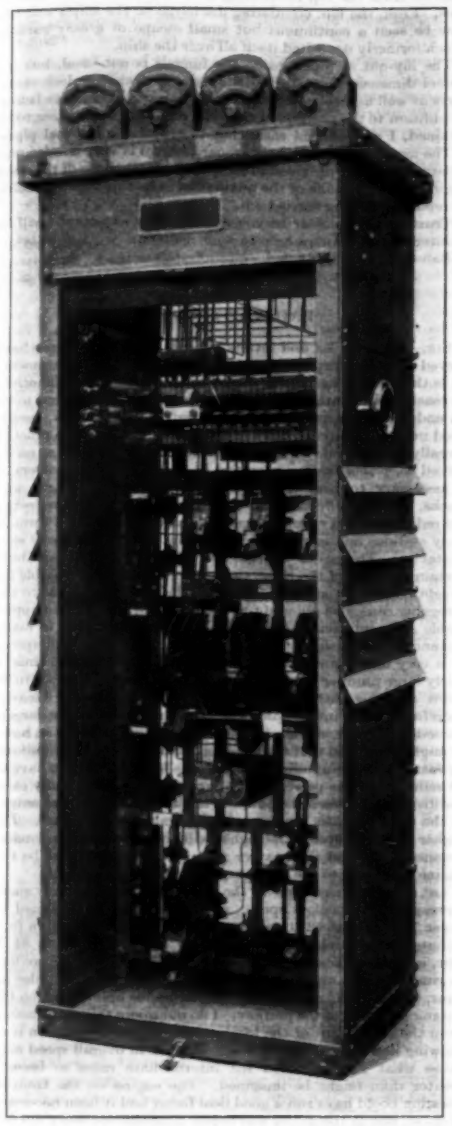


FIG. 3—CONTROL PANEL

trunnions, which acts in opposition to the disturbing force produced by the wave and thus tends to quench the tendency to roll.

The speed of precession is controlled in order to obtain the maximum efficiency from the stabiliser, and also incidentally to limit the gyroscopic forces which are proportional to the precession velocity, and such speed control is characteristic of the active type of stabiliser. This type of apparatus is designed with the object of anticipating the waves, and of starting to stabilise the ship almost before the latter has begun to move. The extreme sensitiveness is obtained in the light control gyroscope, which does not weigh more than 150 lb., and is revolved at a speed of 5000 to 6000 revolutions per minute by its electric driving motor. This unit indicates the roll of the ship a fraction of a second after its starts, and by means of an electrical relay and control panel immediately sets in motion the precession motor and starts the precession of the main stabilising gyroscope, instead of waiting for the waves to do so, as takes place in the case of a stabiliser of the passive type. It is claimed that, as the result of using this arrangement, the full stabilising effect is obtained about one and a-half seconds after the roll starts, and according to the design the ship may correspond with a limit of 1.5 degrees to 2 degrees roll on each side of the mean position.

The Main Stabilising Gyroscope.

The main stabilising gyroscope is illustrated in Fig. 1, where it is shown arranged for shop trials at Trafford Park. The rotor disc is 78in. in diameter, has a width of face of 17¼in. and weighs about 18,500 lb. The disc is rotated by a motor of the three-phase induction type, the rotor of which is attached to the lower part of the gyroscope shaft, while its stator is attached to the gyroscope casing. The stator frame is water-cooled from an outside supply, the cooling water being conducted to and from the casing through flexible connections, and current is supplied from the switchboard by flexible cables. The full speed of the disc is 1500 revolutions per minute. At speeds above half full speed the windage losses are considerable, and in order to reduce them as far as possible, the main parts of the disc are enclosed in a casing, from which the air is exhausted to a degree of vacuum of about 15in., a precaution which it is said produces, in the case of this particular equipment, a saving of nearly 13 brake horse-power. Fig. 2 shows a cross section through a stabiliser similar in design to that supplied to the British Admiralty, and will serve to indicate the arrangement of the rotor disc and shaft, the driving motor, and the cast steel casing with its horizontal bearings and the precession segment. The centre shaft is supported on a Michell thrust bearing, and the main bearings are also provided with spherical self-aligning seats. All bearings are lubricated under a pressure of 8 lb. per square inch, and the lubricating oil further serves as a cooling medium for the working surfaces of the bearings. It may be noted that all the bearings and journals through which the gyroscopic stabilising forces are transmitted are specially designed to withstand heavy loads. The horizontal gudgeon bearings are of the roller type, and smaller ball thrust bearings are also fitted to take up any unbalanced thrust forces. By controlling the velocity of precession, the forces acting may be limited to a known amount. This control is effected through the precession motor, a speed-reduction gear, and the mechanical and electrical braking with which the motor is fitted. In all there are three gear reductions giving a total ratio of 110 to 1 between the speed of the precession motor and that of the movement of the main gyroscope. The reducing gears and bearings are lubricated from a direct-driven oil pump of the gear type, and an auxiliary motor-driven pump maintains the oil supply until such time as the speed of the gear pump is sufficient to prime it. In the motor circuit are placed the controls which operate the mechanical brakes, and these are so arranged that the brakes are automatically released as soon as current flows in the motor armature. At the moment that the current is cut off the brakes are immediately applied and these, together with the electric braking action on the motor itself, serve to bring the precession of the main gyroscope to a dead stop in a fraction of a second.

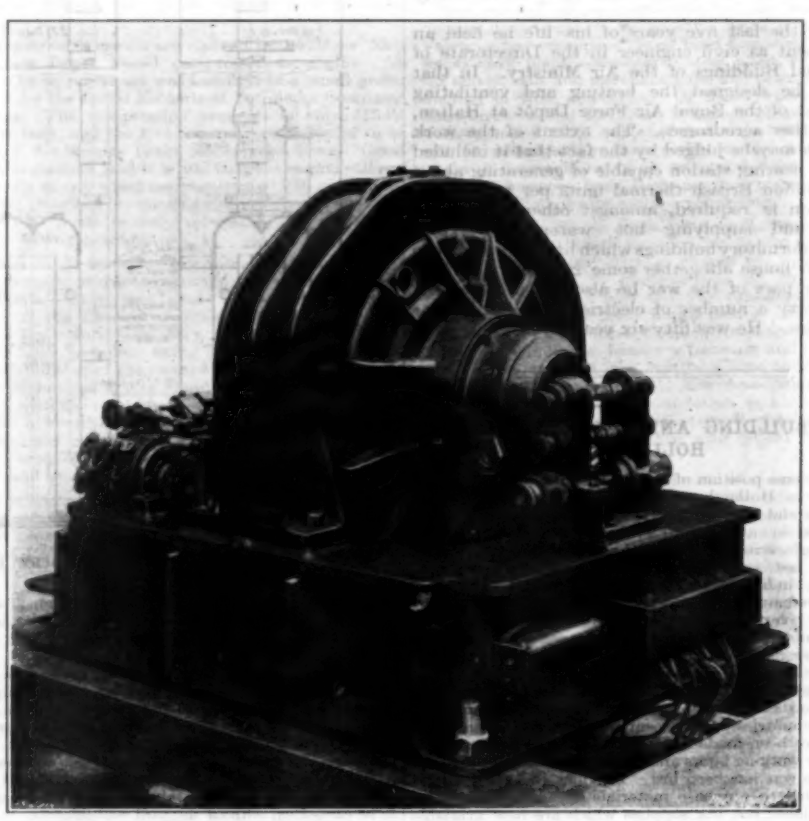


FIG. 4—CONTROL, OR PILOT, GYROSCOPE

Electrical Controls.

The different electrical circuits in the system may be divided into the following groups. The spinning motor circuit for the main gyroscope, the precession motor circuit, the circuit for the control gyroscope, and that supplying the lubricating oil and vacuum pumps.

In Fig. 3 we show the control panel for the precession motor, which is connected to the ship's supply mains. This starting panel is in the form of a relay reversing switch, in which the switch coils are energised from the circuit of the control gyroscope and close the circuit to the ship's supply. With the quick accelerating type of motor which is fitted, the full speed of precession of the main gyroscope is attained in about one second, and when running at top speed, the motor has the flat type of characteristic which is associated with the shunt motor, so that very close speed regulation can be obtained. In addition to the mechanical brakes already described, the armature is braked dynamically by reversing the field across the generator terminals. The mechanical brakes are designed so that they prevent the main gyroscope from precessing passively when the ship is rolling and the precession motor switches are open.

Brief reference has already been made to the control gyroscope and its function. This unit is also operated from the ship's supply mains, and when the starting switch is closed it comes up to its full speed of about 6000 revolutions per minute in a period of fifteen minutes without further attention. A moving arm at the end of the axle makes electrical contact and energises one or other of the two reversing switch coils on the precession motor starter.

Another important unit on the precession system is the centraliser and limit switch, which is of drum form, and which derives its motion from cams attached to the reduction unit of the precession motor. By setting the angular position of these cams it is possible to determine the relationship between the fore and aft position of the main gyroscope and the time of opening and closing of the switches. Two of these switches are set to open when the main gyroscope precesses about 50 degrees from vertical, at which point further precession is automatically stopped.

Two other switches are set so as to close whenever the gyroscope reaches the 45 degree mark. When closing takes place the centraliser coils on the control gyroscope are energised, and these coils in turn operate ratchet and pawl devices compressing or releasing springs, which retard the precession movement of the main gyroscope. Thus, should this unit tend to precess mostly to one side of the vertical, the centraliser will gradually tighten a spring and continue to increase the resistance offered against the movement of the control gyroscope which causes precession of the main gyroscope in that direction.

The function of the centraliser and limit switch is, therefore, that of keeping the main gyroscope precessing in equal arcs each side of the vertical and within limits of 110 deg. to 120 deg. total arc.

Vacuum and Oil Pumps.

The only other important units of the equipment are the vacuum and lubricating oil pumps. The vacuum pump has the duty of maintaining a constant vacuum of from 14in. to 16in. in the casing inside of which the stabiliser rotor disc revolves, while the oil pump furnishes oil under pressure for the cooling and lubrication of the stabiliser bearings. The lubricating system is arranged so that all oil drains down into the lower cap of the gyroscope unit—shown in Fig. 2. The gear type of lubricating pump is arranged in this cap, so that it draws its supply from

the oil sump. From this part oil is delivered to one of gudgeon bearings and, after filtering and cooling, is brought back through the other gudgeon bearing to the main bearings of the gyroscope. When starting up, the auxiliary motor-driven lubricating pump is used until the gyroscope reaches about half speed, after which time the auxiliary may be shut down, and the direct-driven gear pump in the lower cap takes up the service. By adjusting the amount of water flowing through the oil cooler, the temperature of the oil entering the inlet gudgeon is maintained between 95 deg. to 105 deg. Fah. A pure mineral oil of medium heavy grade is used. It has a viscosity of 130 "Saybolt" seconds at 100 deg. Fah. In addition to the equipment we have described, a further installation with a gyroscope having a disc 87in. in diameter is at present under construction at the Elswick Works of Sir W. G. Armstrong, Whitworth and Co., Limited, where it is being made to the order of the Sperry Gyroscope Company, Limited.

Obituary.

HERBERT E. MITCHELL.

Mr. Herbert E. Mitchell, who died suddenly of heart failure on July 23rd, at 13, Victoria-street, Westminster, was a member of the Institution of Civil Engineers and of the Institution of Electrical Engineers. He had been engaged in the profession since 1888, when he became chief assistant to Professor George Forbes, F.R.S., and was responsible for several electricity supply undertakings, and the equipment for power, light, and heating of various public institutions and factories in London and the provinces.

One of his chief undertakings while in private practice was the preparation of designs and specifications for the heating and ventilating of the New County Hall for London. Though not executed in its entirety, owing to changed conditions due to the war, the most original part of this work, the heating and ventilating of the Council Chamber, has, we believe, been carried out substantially in accordance with his design. The method of individual control of the air supply by members at their seats is a novel feature in such work, and seems likely to be widely adopted.

During the last five years of his life he held an appointment as civil engineer in the Directorate of Works and Buildings of the Air Ministry. In that capacity he designed the heating and ventilating equipment of the Royal Air Force Depôt at Halton, and of other aerodromes. The extent of the work at Halton may be judged by the fact that it included a central heating station capable of generating about eleven million British thermal units per hour. The installation is required, amongst other things, for heating and supplying hot water to sixteen blocks of dormitory buildings which have recently been erected to house altogether some 2000 lads. During the latter part of the war he also prepared for the Air Ministry a number of electrical installations for aerodromes. He was fifty-six years of age.

SHIPBUILDING AND ENGINEERING IN HOLLAND.

The adverse position of many firms of shipbuilders and engineers in Holland, resulting from wage and labour conditions and the effect of the occupation of the Ruhr, is reflected in a report on the working of P. Smit Junr's Engineering and Shipbuilding Company, at Rotterdam, for last year. This report, says the *Journal of Commerce*, indicates that conditions generally in shipbuilding remained bad throughout the year. A few contracts for river craft were secured at low prices, but the firm was not able to secure orders for sea-going tonnage. Prices were reduced 10 to 15 per cent. in October, 1921, and a further 5 per cent. in July, 1922, and again 6 per cent. in October, 1922; but such reductions did not enable the firm to secure foreign orders. The reduction of wages in other countries would seem to be greater than those which have been made in Holland, and the advantage of the longer working hours and lower wages which prevailed before the war has been lost. Previous to 1914 Holland was enabled to purchase materials cheaper in Germany than England, but the supplies which are now available in Germany are negligible, and as the materials have to be imported from England it is clear that British industry is in the more advantageous condition. If Dutch industry is to revive, it will be necessary for the Dutch Government to co-operate by allowing longer working hours than the existing forty-eight per week and by removing some of the cumbersome industrial legislation. In general the political conditions on the Continent make normal business impossible. Deliveries of material are often delayed and the abnormal exchange rates tend to induce shipowners to refrain from placing ship repairs and new ships in Holland. Signs of improvement appeared towards the end of last year, when more inquiries were received; but such improvement was quickly dispelled by the occupation of the Ruhr. Rhine navigation has practically ceased, and there appears to be little desire to renew or to improve the fleets of this class of tonnage, while repair work on Rhine tugs and barges is not forthcoming. Material which was ordered from the steel works in December and has now been ready for some time cannot be delivered. Among the work completed by the firm in 1922 was a pontoon for a floating crane, several tugs and two colliers for the Coal Trading Association of Rotterdam, while the work on hand includes a Rhine tug and twelve Rhine barges and a floating landing stage. Early in the year the company secured an order for two cranes for the Corporation of Antwerp. Despite difficult conditions, another Dutch firm, the Nederland Shipbuilding Company, of Amsterdam, has recently secured the contract for constructing a twin-screw motor tanker of 13,000 tons deadweight carrying capacity. This vessel will, we understand, be fitted with Werkspoor four-cycle Diesel oil engines, which will be made at the works of the Werkspoor Company in Amsterdam.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

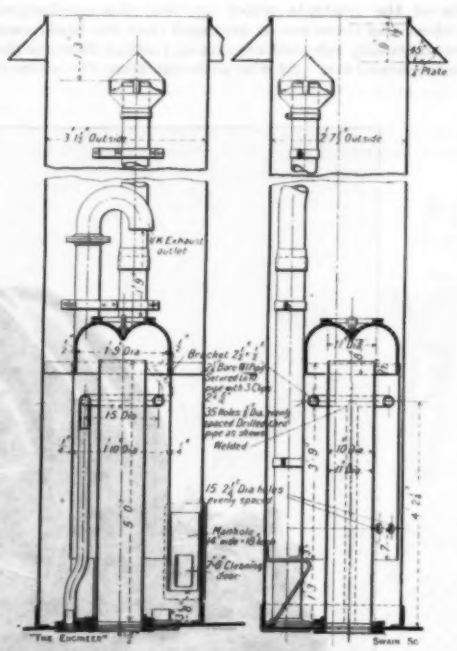
SPARK QUENCHING FUNNELS FOR SOLID INJECTION ENGINES.

Sir,—In case it might be of interest to some of your readers, I enclose a drawing of an arrangement of funnels which I designed for my yacht Sea King, and which has entirely got over the trouble I formerly experienced, namely, the emitting of large pieces of incandescent carbon, which set fire to awnings as well as burnt deep holes in teak decks. In fact, on one occasion, whilst at sea, we had two boats in davits on fire at the same time owing to sparks, and on another occasion a piece of incandescent carbon about the size of a hazel nut fell on to the frame of a teak skylight and, unobserved, burnt its way through 2¼in. thick.

My experience is that periodical cleaning of exhaust pipes and silencers is no certain preventative. The quality of the fuel oil varying at different ports even when obtained from the same company. I have tried secondary silencers, but these I find add to the trouble, as the condensation of unburnt oil is entrapped and catches fire when least expected. The fouling of silencers and exhaust pipes is largely due to the fact that the semi-Diesel engine is not adapted to run on light loads continuously.

One of my lighting sets is 18 brake horse-power, and for weeks on end only perhaps 3 kilowatts is developed during day load; hence, notwithstanding light load devices, the silencer catches fire.

I would point out that the bottom ends throw up into the



SPARK ARRESTING DEVICE IN A YACHT FUNNEL

cylinder a considerable quantity of oil, which cannot be cut down, especially in tropical climates. Injecting water into engine silencers or exhaust pipes is, for obvious reasons, out of the question.

The discomfort of a dirty ship, to say nothing of the cost of repairs, became so annoying that I set myself the problem to cure the trouble, and devised an arrangement which has turned out a complete success. The alteration entailed a great deal of work, necessitating an entirely different lay-out of piping, increasing the circulating discharge to 6in., and, owing to the funnel seating spaces being restricted, oval funnels had to be resorted to. There being no shipyards at hand, the erection had to be carried out without shipyard conveniences.

On referring to the drawing, which represents the port funnel, the exhaust from the main port engine is carried up the stand pipe, which is 10in. in diameter, and over which is provided a hood, made of cast iron, the lower extremity being of mild steel. A cleaning hole, 1in. larger in diameter than the exhaust pipe, is provided. The whole of the circulating water comes up a stand pipe, which discharges through holes around a ring, which in turn directs the water on to the 10in. exhaust, as well as on to the hood. The lower end of the hood is drilled with fifteen holes 2½in. diameter, causing a proportion of the cooling water to be blown around the outer casing, adding to the cooling effect to the rising exhaust. There is a drain 3½in. in diameter, standing 3in. high, so as always to retain water in the base. Over it is provided a strum box to prevent any possibility of the discharge overboard becoming choked by waste or other matter. The holes in the strum box are large enough to pass all average lumps of carbon.

A manhole, is provided at the base, in addition to a cleaning door 7in. by 6in., on which is provided a 2in. brass plug peephole.

The exhaust pipe from the second auxiliary engine, is furnished with a bend, so as to to ensure that the sparks fall into the water below. The circulating water from the auxiliary engine is delivered into the base of the funnel through a connection, not shown, and overflows through the drain.

The galley chimney and the chimney from the hot-water boiler—shown side by side—are carried up to within 15in of the top of the funnel casing, the soot from them also falling into the base. The heads of these pipes are blanked all round to prevent any possible heat from the exhausts being transmitted back into the smoke chimneys.

All internal pipes as well as chimneys are of heavy wrought iron steam pipe. The plating forming the funnel casing is of mild steel, $^{9}/_{16}$in. thick for a distance of 5ft. from the base-plate. The plates above are ¼in. thick. The weight of each funnel complete is in the neighbourhood of 1 ton 10 cwt.

The arrangement has surpassed my expectations. The noisy beat of the main engines has entirely disappeared, and the exhaust from the top resembling that of a boiler under banked fires. From the 6in. circulating discharge on the ship's side can now be seen a continuous but small escape of greasy carbon, which formerly deposited itself all over the ship.

The lay-out of pipes inside the funnels is not ideal, but the funnel dimensions being limited, owing to existing deck structures as well as steel casings in connection with alleyways below, in addition to the position of the 10in. main exhaust having to be retained, I was obliged somewhat to crowd the internal pipes.

The arrangement for the starboard funnel is very similar, but separate pipes are provided in each case, enabling one of the main engines as well as one of the auxiliaries to be run whilst cleaning or repairs are being carried out.

Trusting this is clear to you and that my experience will be of interest and perhaps help to your readers. Bliss.

Bahamas, W.I., July 2nd.

RAILWAY SPEEDS.

Sir,—The articles and letters on this fascinating topic have served a useful purpose by helping to bring out the arguments of both sides. The ability of our modern express locomotives to reach and maintain very high rates of speed for several miles on end has frequently been demonstrated. That point, surely, need not be laboured. But the problem of putting into practice a really substantial increase in scheduled speeds is not so easily solved as, *prima facie*, it seems to be. Among other matters, it is necessary to bear in mind signal checks, permanent way slacks, and the effect of adverse gradients, also the necessity for reducing speed round dangerously sharp curves, and through busy stations and complicated junctions. There are many such obstacles. The result is, that on most of our railways only certain portions of the lines, varying in length, are available for exceptionally fast running. If, now, the loss of time due to the foregoing causes be allowed for, it will be obvious that an appreciable augmentation in start-to-stop speeds will mean, in many instances, the raising of the intermediate and downhill speeds to a very high figure indeed. As it is, in order to keep time, a fairly large number of our trains have to travel at from 70 to 80 miles an hour, here and there, on their journeys. Clearly, therefore, these intermediate rates would have to be largely exceeded if the mean velocity be raised by several miles an hour. It might be argued that the running could be made more uniform by faster working uphill. True, but the load would then have to be reduced, or the power of the engine increased. In any case, the disparity between the power of the locomotive and the weight of the train becomes greater as the overall speed is raised. The higher the mean speed, the higher will be the running and maintenance costs, and the heavier and more powerful must be the engine relatively to the load hauled.

Let me give an example of the effect of a comparatively small increase in the booked speed. I once tested a train timed to cover 76½ miles at 52.3 miles an hour. We did the trip in four minutes under time, thus raising the average speed to 54.9. But, in order to accomplish even this moderate average, we had to run 63½ miles out of 76½ at a rate of practically 58 miles an hour, owing to 12¼ miles of nearly continuous uphill work on the outgoing portion of the journey. I do not quote this performance from the standpoint of the locomotive; I merely mention it as showing how a quite unimportant increase in overall speed may cause what I have called the intermediate rates to become greater than might be imagined. The engine on the train in question could have run a good deal faster had it been necessary to do so, but as the driver was before time this necessity did not arise. The line is a moderately graded one.

From the locomotive point of view—apart from the full observance of the conditions essential to safe running—there is nothing to prevent our engines attaining much higher average speeds except one thing, and that is the load behind the tender. If, as on the last day of the railway race of 1895, the load be sacrificed for speed, purely and simply, then it is questionable if it be a paying proposition. A big increase in speed necessarily involves a reduction in the weight of the train for a given tractive power. It may be, as Mr. Rickie has said, that an improved valve gear will help us.

I do not, however, wish to convey the impression that much higher intermediate speeds than those at present obtaining on our railways would in themselves be either impracticable or dangerous. The contrary has been proved to be the case. But I do say that trains timed at, let us assume, from 65 to 70 miles an hour, start to stop, and working over lines with adverse gradients and with other unavoidable checks, would, in more ways than one, be very expensive to operate. If they could be made to pay, well and good. F. W. Brewer.

Stevenage, July 30th.

TRAFFIC CONGESTION IN LONDON.

Sir,—With reference to my letter appearing in your issue of June 29th under the above heading, it has been suggested to me that there are two oversights in the plan of the proposed scheme of overhead arteries for London to relieve the congestion of traffic.

With respect to the first suggested difficulty, the southern overhead artery would, of course, pass *over* the railway bridge on Ludgate-hill, and then pass over Ludgate-circus at a higher level, and the higher level would be maintained through a portion of Fleet-street in order to reduce the gradient.

With regard to the second suggestion, no difficulty need arise about the connection of the Finsbury-square branch of the northern artery in joining this to the main northern overhead artery above Holborn-viaduct. The gradient could be made very slight in rising to this level, as the rise could commence from near the end of Long-lane.

London, July 31st. J. D. Roots.

Railway Matters.

Owing to the North Staffordshire and Caledonian Railway Companies having joined the London, Midland and Scottish Railway Company since its constitution as from January 1st last, it has had formally to be reconstructed. This was done on July 1st, and on the 26th ult. a meeting of the proprietors was held to elect a new board of directors, which includes representatives of the two companies first named.

The 10.20 a.m. from Paddington now runs to Chester with only the one stop at Birmingham—195 miles in 223 minutes, and to Welshpool, after staying ten minutes at Birmingham, with a call at Wolverhampton only—172¼ miles in 228 minutes. This train now runs through to Aberystwyth instead of only including through coaches, as in pre-grouping days. The journey is made in 5 hours 55 minutes instead of 7 hours.

It is announced that the New Zealand Government proposes to call for tenders for the construction, in a difficult portion of the north of the island on the east coast, of 18 miles of railway, linking Taurango with Auckland. The proposal involves a change from the present policy of construction by the Public Works Department. Tenders are to be called for immediately from Great Britain, Canada, the United States, Australia, and New Zealand.

The Canadian Government has given notice of a Bill authorising the Canadian National Railway to construct or complete twenty-nine branch lines at a cost of approximately 27,000,000 dols. in the course of three years. The programme embracing these extensions was recommended by Sir Henry Thornton. A number of additional projects for the acquisition of existing lines in Eastern Canada and the building of extensions in the West were advocated in the course of the debate.

The figures as to the number of passengers carried in January last are, owing to the amalgamations of the companies, only now available. They show an increase of 3.65 per cent. as compared with January, 1922, in the number of passengers, but due to the reduction in fares, a falling off of 9.35 per cent. in the receipts. It is significant that with an increase of only 3.65 per cent. in the volume of traffic, there was an increase of 7.86 per cent. in the passenger train mileage.

Whether by accident or design the map in "Bradshaw" of the area covered by the London, Midland and Scottish Railway Company does not show any connection between Edinburgh and the former Caledonian route to the south. More remarkable still, the Waverley route between Carlisle and Edinburgh, which, although used by trains from St. Pancras, belongs to the London and North-Eastern Railway, is shown in the same thick lines as the main system of the London, Midland and Scottish.

The railway service has lost and private civil engineering practice has gained, by the retirement of Mr. D. L. Rutherford, who was the chief engineer and locomotive superintendent of the Furness Railway until its amalgamation. Mr. Rutherford went to that line from the North British Railway and he now returns to Edinburgh to practise as a consulting engineer. The divisional engineer for the Furness and West Cumberland districts is now Mr. H. Brown, late of the Maryport and Carlisle Railway.

The Adelaide correspondent of *The Times*, cabling on the 26th ult., says that the Governor of South Australia, when opening the Parliament of that State, outlined an expenditure of four and a-half millions, spread over five years, on public works. There is to be a thorough reorganisation of the railways with a view to effecting economies and reducing freights and fares. It will be remembered that last year the South Australian Government brought in an American railway officer as chief commissioner of railways.

The formal opening of the first electrified portion of the Arlberg railway line between Innsbruck and Telfs, a distance of 17 miles, took place on July 22nd. Work is now proceeding on two other lines in Salzkammergut, and it is anticipated that all the lines will be open to traffic at the end of next year. Two types of locomotives will be used on the Arlberg line; one of 2000 horse-power for the steeper gradients, and one of 1000 horse-power for medium inclines. The whole work is being carried out with Austrian capital without assistance from abroad.

The railway statistics for January last have only just been published. Their preparation has been delayed by the amalgamation of the companies. As against January, 1922, there was an increase of 19.36 per cent. in general merchandise, of 25.43 per cent. in coal, coke and patent fuel, and of 66.36 per cent. in other minerals. All goods traffic increased by 29.67 per cent., and this was carried with an increase of only 20.25 per cent. in the ton-miles. The receipts advanced by 4.89 per cent. despite the reduction in rates. Whilst the goods train miles increased 16.20 per cent., the average train load rose from 127½ tons to 134 tons, and the net ton-miles worked per engine hour from 429.34 to 452.85.

Yesterday—Thursday—was the fiftieth anniversary of the Wigan railway disaster of August 2nd, 1873, when the rear portion of the "Tourist Express" left the rails and ten passengers were killed. Captain Tyler inquired into the accident, and ascribed it to have been due to oscillation of the train when passing over some facing points leading to a loop line. The executors of the late Sir John Anson brought an action against the London and North-Western Railway Company, which was tried in the Queen's Bench in June, 1875, and the conclusion then come to was that the signalman moved the points under the train. The wheel base at that time was very short, and it seemed impracticable for this to have been done, but it was shown that a train for Manchester was waiting at Springs Branch which would have to go into the loop, and it was supposed that the signalman restored the signal before the express had passed and, from force of habit, then moved the points. It was significant of the little appreciation some railway companies had in those days for safety appliances that the locking bar—which would have saved that accident—was then six years old, but on the whole of the line between Warrington and Carlisle only one was fixed. At the trial two years later there were twelve.

Notes and Memoranda.

A new electric lamp for microscope work has some special features. An obscured electric lamp is used, but is so arranged that there is no interference with the image by a projected granular luminous surface. The size of the luminous source can be adjusted by shutters, and there is a special holder permitting the use of colour-filters of any size.

The Cast Iron Pipe Publicity Bureau of Chicago has been investigating the life of cast iron pipe in municipal water distribution, and has discovered some pipe laid in Philadelphia in 1801—122 years ago—and still in use. According to the Bureau's records, pipes laid in Pittsburg in 1824, in Baltimore in 1829, and in New York in 1832 are also still in service.

The speeds at which it is politic to wind men in mine shafts were recently discussed by the Engineers' Society of Western Pennsylvania, and it was said that speeds up to 5000ft. per minute had been used, although in some states the limit was put at 600ft. per minute. Several speakers appeared to favour speeds ranging round 1500ft. and 2000ft. per minute.

When completed, the water area of the King George's Dock at Calcutta will be about 190 acres, the length of the quay wall 25,000ft., and the number of berths will be thirty-five. The entrance lock will be 700ft. in length and 90ft. wide, with a depth of water on the sill of 32ft. at lowest low water, and 56ft. at highest of high water. Three-storied sheds are to be provided, each containing a total floor area of 187,000 square feet, with estimated accommodation for 14,000 tons of cargo.

An American dental company which uses 3-phase electric ovens for japanning the metal parts of its apparatus, reports that electricity was substituted for gas in order to ensure a high finish. The number of rejections due to imperfect baking has fallen from 20 per cent. with gas to less than 4 per cent. The cost of operation is about the same as with gas, but the temperature is automatically kept constant, and the baking time is less, resulting in increased output. Some of the ovens measure 7ft. by 7ft. by 7ft., and can deal with two truckloads of material simultaneously.

Some useful purpose may at last, it appears from a note in the *S.A. Mining and Engineering Journal*, be found for the vast dumps of the Rand gold mines. Samples of sand, freed from cyanide, and local lime have been experimented with, and it is claimed that the bricks made with these materials fill all the purposes of faced bricks at a low cost. They are hard and grey-white in colour. It is stated that 56,000 of these bricks can be turned out per day at a cost of 27s. 6d. per thousand. A crushing resistance of over 4000 lb. per square inch has been obtained, and a degree of hardness far surpassing clinker bricks.

Some remarkable results are claimed in the *Motor Ship* for the new Deutz Diesel compressorless engine. A 120 brake horse-power set was installed in a small motor tug owned by the Royal Netherland Petroleum Company, Rotterdam. The compression pressure is only 325 lb. per square inch, and the fuel consumption is stated to be well under 0.4 lb. per brake horse-power-hour. Great flexibility is claimed, and it is said that the engine will run satisfactorily at any speed between 40 and 250 revolutions per minute. Engines having an output of above 200 horse-power will be made directly reversible, but below this power a reversing gear is fitted.

Carburisation tests to determine the feasibility of making synthetic grey iron in an indirect-arc rocking-type electric furnace have been made at Detroit, Mich., by engineers of the Bureau of Mines, Department of the Interior. The results were very gratifying, an excellent quality of grey cast iron being produced in every test. The carbon content of the metal was under control. With this type of furnace it was found best to mix some grey iron scrap with the steel scrap in order to get the melting started at a lower initial temperature, and thus avoid overheating the roof. Test bars, 1¼in. in diameter, were made and broken on 12in. centres. Deflections as high as 3.65 deg. and breaking strengths of 3000 lb. were obtained.

There is being built over the Delaware River, between the cities of Philadelphia and Camden, a large bridge which will have a main span of 1750ft. between centres of towers, or 154ft. more than that of the Williamsburgh Bridge, at New York, at present the longest suspension bridge in the world. It will be a single-deck structure, with only two cables, while the three New York bridges have each four cables and two decks. A 60ft. roadway in the middle of the deck will be flanked by a tramway track on each side, inside the cables, and two rapid-transit railway tracks outside the cables. Two 10ft. footpaths will be carried over these latter tracks by cantilever brackets on the stiffening trusses. The use of two cables is based, according to the *Canadian Engineer*, on the fact that the stresses are more definite, and because a better arrangement of the floor space can be obtained. Instead of relying on rigid steel or masonry towers carrying roller saddles to take up the motion of the cables over their bearings, the towers are designed to take up this motion.

At the annual general meeting of the American Iron and Steel Institute, a paper was presented by Mr. H. T. Morris, in which the more serious sources of wastage of material and labour in steel manufacture were reviewed generally, and suggestions put forward for their elimination or reduction. Amongst the more prominent changes in technique foreshadowed with this end in view were oxygen enrichment of air supplied to producers, electrification of rolling mill drives, standardisation of plant units, processes and methods of sampling and testing, and application of modern scientific knowledge to the production of sounder ingots. More thorough utilisation of by-products was advocated and recovery of metal from slags, improvements of transportation facilities inside the works, with greater co-ordination of effort generally, were also amongst points dealt with. Stress was laid upon the need for consideration of matters affecting the worker in his home and community life. Education, accident prevention, housing, and service pensions were included in this category.

Miscellanea.

The contract for the construction of a bridge over the bay at San Francisco has been awarded to the Pacific Construction Company, at a price of 10,000,000 dols.

In 1914 the motor vessels afloat amounted to 220,000 tons gross. According to the recently published edition of Lloyd's Register book, the figure has now reached 1,666,385 tons.

The new equipment of the Natal Navigation Collieries, which is now practically complete, is claimed to be one of the finest of its kind. It is intended to wind over 2000 tons of coal per working day.

The annual report of the Chief Inspector of Factories and Workshops for the year 1922, just issued as a Blue Book, states that 97,986 accidents, including 843 fatal, were reported, an increase of 5421 over the year 1921, The total number of machinery and other "one day" accidents was 29,533 and of non-machinery accidents 68,453, as compared with 27,772 and 64,793 respectively for the previous year.

On Wednesday, July 11th, the electricity supply station at Westbank, Portobello, was formally opened by the King. His Majesty was accompanied by the Queen and the Duke and Duchess of York. The occasion was of exceptional interest in that this was the first of the new super-stations to be opened by the King in person, and it was a compliment to electrical engineering, as it was the only public function in which their Majesties had agreed to take part during their stay in Edinburgh.

A contract has been signed at New York between the Western Union Telegraph Company and the Italian Submarine Cable Company under which the latter company undertakes to lay a cable between Rome and the Azores and the former to lay one between New York and the Azores, where it will be connected with the Italian line. There has been some delay in securing landing rights at the Azores from the Portuguese Government, but it is expected that they will be obtained in the near future. If not, another joint station will be decided upon by the cable companies.

The engine works of the Ansaldo San Giorgio Company at Turin have again, we understand, passed into the hands of the Fiat Company, and in future will be known as the Fiat Stabilimento Grandi Motori. A large number of submarine engines were built at this factory, and during the period of the Ansaldo San Giorgio Company's control several sets of two-cycle Diesel machinery were constructed for cargo and passenger ships. There will, it is said, be no alteration in the general policy pursued, and the works will be developed for the building of two-cycle Diesel engines for marine and land use.

The scheme of reconstruction for the works of the Société des Forges et Aciéries du Nord et de l'Est at Valenciennes comprises three blast-furnaces, basic Bessemer steel plant, open-hearth steel plant, rolling trains for billets, rails and merchant bars, and plant for the production of tires and axles. Of these departments, the blast-furnaces and the basic Bessemer plant are now in working order. It is expected that the whole programme will be completed in from eight to ten months. The works at Louvroil are in an advanced stage, comprising two blast-furnaces, basic Bessemer steel plant, and rolling trains for billets, hoops and merchant iron.

The Mansion House Association on Railway and Canal Traffic for the United Kingdom at the annual general meeting held on July 27th at 96 and 98, Victoria-street, Westminster, S.W. 1, re-elected as its President, Sir Herbert Matthews; also the Vice-presidents, with the addition of Major-General Sidney Seldon Long, C.B., the Parliamentary Committee, Council, Executive and General Purposes Committees, honorary treasurer and chairman of committees, and will in a few days issue to its members its forty-first annual report. The Association has been closely identified from its foundation with all legislation on transport matters, and with every effort to promote and protect the interests of traders with regard to transport questions generally.

In commenting on the explosion of a cast iron steam pipe at Burnley Union Workhouse, the engineer surveyor-in-chief, Board of Trade, remarks that the lack of uniformity in the thickness and in the quality of material found in the pipe which failed are not uncommon characteristics of cast iron piping, and in these respects cast iron pipes compare most unfavourably with those made of wrought iron or steel. The latter possess, moreover, greater flexibility, and being more resilient are better able to withstand the severe stresses due to variations of temperature and water hammer to which steam pipes are liable. A noteworthy feature of the case was the presence of mind and determination shown by the stoker, Wright Clarke, who, although so severely scalded that he shortly afterwards died, closed down the stop valve, thereby doing all that was possible in the circumstances to limit the consequences of the explosion.

After having been at a standstill for seven months, the extensive Austrian establishments known as the Wöllersdorf Works are, according to the *Iron and Coal Trades' Review*, to be gradually set in operation again under new management. These works, which are situated near Wiener-Neustadt, were the largest iron and steel plant in Austria during the war, and were exclusively used for the production of war material, employing some 45,000 men. After having been transformed to making peace material, the works provided employment for 4500 men under State control, but as the losses incurred were considerable the Government in 1922 accepted an offer made by the Berlin Allgemeine Elektrizitäts Gesellschaft (A.E.G.) to form a company to take over the undertaking. Owing to the scarcity of orders, however, the company was compelled to shut down, but arrangements have now been made for the reopening of the works as a result of an agreement between the Austrian Government, the A.E.G. and a new concern known as the Pochwadt-Adler-Sklary group. The latter, which will take over the shares held by the A.E.G., consists of Herr Adler, an Austrian industrialist; Herr Pochwadt, of Berlin; the Ferro-Metal Company, of Zurich; and certain London interests.

ELECTRIC WINDING EQUIPMENTS FOR COLLIERIES

(*For description see page* 117)

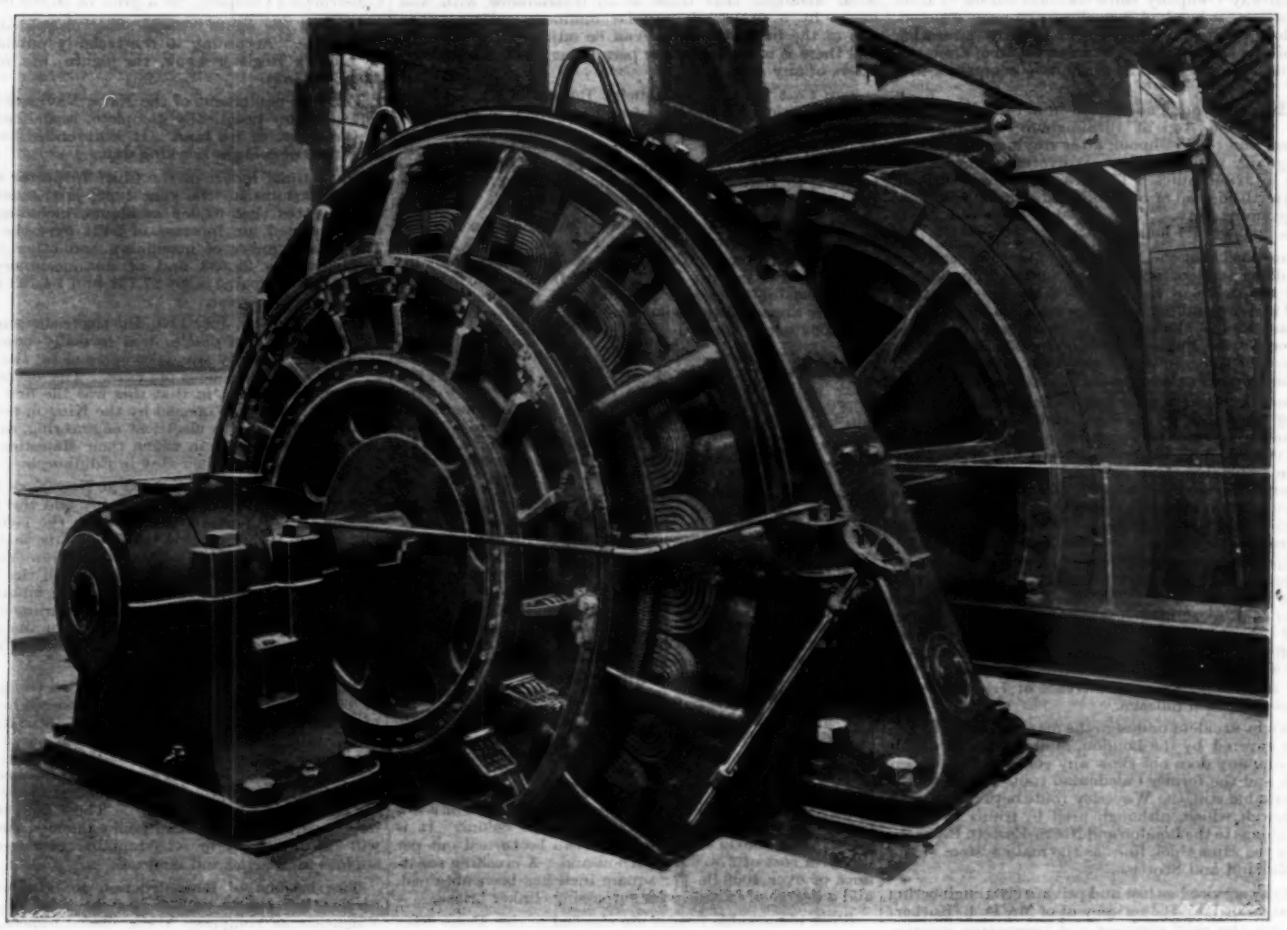


FIG. 18—ELECTRIC WINDER AT THE "DO WELL" COLLIERIES

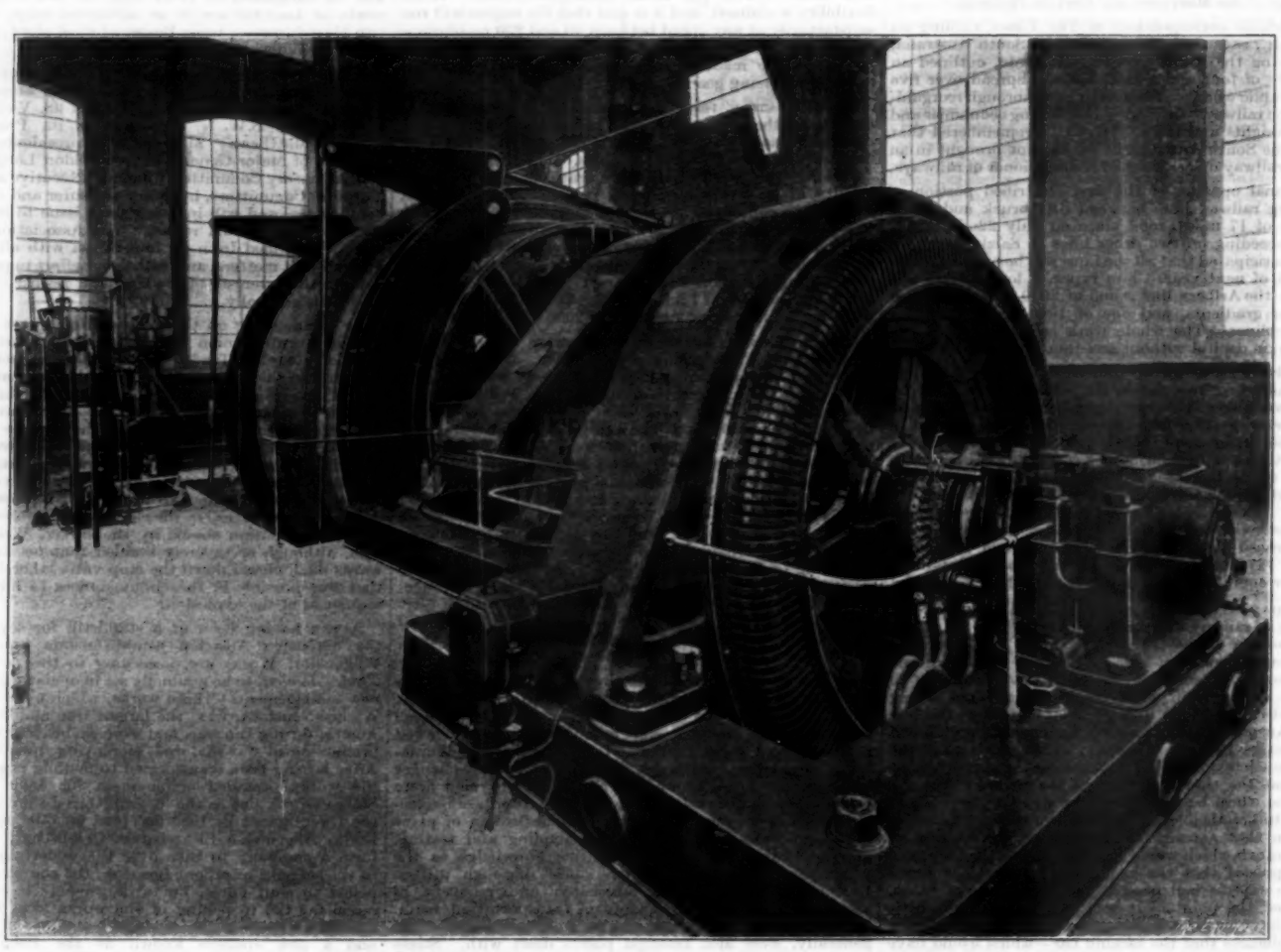


FIG. 19—ELECTRIC WINDER AT THE POWELL DUFFRYN COLLIERY

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AUGUST 3, 1923.

The Singapore Naval Base.

Naval affairs are at the moment occupying the thoughts of the nation to a greater extent than at any period since the war. The Government, acting on advice tendered by the Committee of Imperial Defence, has recently taken a decision which opens all eyes to the new strategical conditions now confronting the Empire. We refer, of course, to the Singapore development scheme, which exemplifies in striking fashion the gravitation of naval power towards the East. Some twenty years ago the growing strength of Germany's fleet and its reaction on the political situation left us no choice but to concentrate our main force in northern waters. From that time down to the outbreak of war, all our best ships were kept on the Home station, within easy reach of the North Sea, thus reversing the previous policy, adhered to for generations, of maintaining the bulk of the Fleet in the Mediterranean. In each case the disposition was justified by sound strategy, which enjoins the concentration of force where it is most likely to be needed. Just as the great military Powers of the Continent have always built their strongest fortresses and established army mobilisation centres in proximity to their most exposed frontiers, so have the main squadrons of the British Navy always been found within striking range of the next strongest fleet. It was therefore inevitable that some modification would take place sooner or later in the arrangement of our naval forces, the present distribution of which bears no relation to strategical requirements. At an early date, we understand, one of the two battle squadrons of the Atlantic Fleet will move down to the Mediterranean, which will then become once more the principal command. But even when this is accomplished, much will remain to be done ere the Navy regains its former ability to keep watch and ward over the Empire's communications in every sea, and, if necessary, to assert its full power in any part of the navigable globe.

Without adequate bases a modern fleet is rendered practically immobile; its freedom of operation is dependent on the existence of sheltered ports where it can replenish with fuel and other essential supplies, and make good any damage suffered in action or through other causes. Fuel stations, magazines and docks are elements no less indispensable to the exercise of naval power than ships themselves. Realising this, the Admiralty has been striving since the war to enlarge the strategic radius of the Fleet by setting up oil fuel stations at suitable points along the main ocean routes, and provision is made in the current Estimates for new tanks at Malta, Aden, Ceylon, Rangoon and Singapore. Before capital ships attained their present huge dimensions, the British Empire was not ill-provided with docks able to accommodate the largest fighting ships. A case in point is Singapore itself, which has been a defended base ever since the year 1882. There is already a graving dock at this port which can take ships up to 850ft. in length, 92ft. beam, and 32ft. draught, dimensions that were ample a few years ago, and would be so to-day were it not for the greatly increased beam of ships equipped with bulge protection. This device has already been fitted to ships of the "Royal Sovereign" class, and it is now to be added to the five "Queen Elizabeths." The result is that all our best ships, including the Hood and the "Renown" class, have or will have eventually a beam exceeding 100ft. They will therefore be debarred from using most of the existing docks at home and oversea ports. At the present moment, as the Admiralty has pointed out, we do not possess a single dock in the Far East capable of taking a modern capital ship. The consequence of this deficiency is that we could not send a battle fleet into the Pacific, no matter how urgently it might be needed there. It has been frankly owned by the First Lord that "in all those waters, with such immense consequences to this country from a strategical point of view and for the defence of the Empire, we are absolutely helpless and reliant upon the good will of a friendly and former allied Power." Such a position is consistent neither with the prestige nor the interests of the British Empire, yet it is one that we shall have to endure for a great many years to come—until, in fact, Singapore has been developed as a docking and supply base of the first class. It is proposed, among other improvements, to construct a graving dock large enough to accommodate, at the same time, two vessels of the maximum size allowable under the Washington Agreement. The estimated cost of this undertaking is about £800,000, while additional works contemplated at Singapore, but not including fortifications, will bring the total expenditure to approximately £10,500,000. According to present arrangement, the initial outlay will not be heavy; about £200,000 is to be spent in the next financial year, and very little more in the following year. The completion of the scheme will involve ten years' work, so that the average expenditure per year will be £1,050,000. This is not an exorbitant price to pay for a new base which will so largely increase the Navy's radius of action. Attempts are, nevertheless, being made in certain quarters to discredit the project, alike on economical and strategical grounds. The anti-battleship school is up in arms against the proposal to create a special base for vessels which it proclaims, with wearisome reiteration, to be obsolete. Its chagrin is easy to understand, for the Singapore decision affords striking proof of the confidence which is felt by our highest naval authorities in the great ship. It is more difficult to discover the motive for an agitation which is still being carried on with vehemence, though its original purpose has failed. Ever since the war a few retired naval officers, aided and abetted by aircraft enthusiasts, whose acquaintance with naval technique must necessarily be limited, have been doing their utmost to undermine public faith in the professional competence of the Admiralty. Claiming, by implication, a monopoly of knowledge with regard to naval tactics present and future, they assert that the battleship is absolutely useless, and condemn the building of new vessels of that type as a wicked waste of national funds. Now this question of the battleship's utility was gone into very thoroughly some two and a-half years ago by a Committee, which heard the evidence of nearly all the officers who had held high commands afloat during the war. It is reported on good authority that 90 per cent. of them declared in favour of the battleship as an indispensable unit for the maintenance of British naval power. Certain it is that the Committee, having listened to this evidence by men who had actually wielded in war the weapons they were discussing, unanimously recommended the perpetuation of the great ship. This verdict, we believe, satisfied all reasonable people, and the Government very properly acted on it. As a consequence, we have now on the stocks two battleships, and without doubt both will be duly completed. Under the Washington Agreement, however, we shall not be entitled to build any further battleships for a space of ten years. In these circumstances the critics of the type appear to be wasting ink.

As for the Singapore scheme, the Government has an unanswerable case for proceeding with it. The best naval opinion having decided that we must have battleships, and strategists being in unanimous agreement as to the need of a base

which would enable our most powerful ships to operate in the Pacific, the Government would have been grossly remiss in its duty to the country had it failed to provide either one or other of these essentials. One of the few points on which there might have been room for criticism of the scheme when first mooted was the choice of a graving dock in preference to one of the floating type. There are now in England two docks of the last-named kind, both taken over from Germany, which only need reconditioning to make them suitable for ships of the largest dimensions. It has been officially stated in Parliament that both of them could be taken through the Suez Canal. At first sight, therefore, it might have seemed more economical to station one or both of these structures at Singapore, instead of going to the expense of excavating a new graving dock. We understand, however, that one of the ex-German docks is wanted for Malta, as the dry docks at that station cannot take the bulged "Royal Sovereigns" which are shortly going out to the Mediterranean. This would leave only one available for Singapore, and quite apart from the cost and hazard of towing the huge structure a distance of 8000 miles, the Admiralty considers that this Far Eastern base should be equipped for carrying out hull repairs on two capital ships simultaneously. Hence the decision to build a double graving dock, at an estimated cost of £800,000. The entire scheme will, as we have said, add about £10,500,000 to Navy Votes between now and 1933. Those who are familiar with the local conditions and the constructional work involved do not anticipate that this estimate will be exceeded, so that the wild talk now circulating about an eventual bill for thirty millions is obviously part of the propaganda waged by influences hostile to the Admiralty. This attempt to degrade a well-considered plan for improving the Empire's defences to the level of a "stunt" cannot be too strongly deprecated.

The Tensile Test.

The tensile test is so firmly established in engineering practice and its results are so familiar that we are disposed to accept them without question as an index to the satisfactory quality of our materials in general and of steel in particular. Modern research, however, has not only shown us clearly that the value of a material cannot be determined by its tensile strength alone, but has also evolved several other tests, such as fatigue, single and multiple shock, hardness, &c. Around these, as is inevitable with comparatively new developments, some degree of doubt and controversy still rages, and for a great many practical purposes it is still the tensile test, and that alone, which serves as a practical criterion. It is, perhaps, desirable to ask the question whether this implicit, if tacit, confidence in the tensile test is justified, and whether this test is ordinarily carried out in a satisfactory way and interpreted in a rational manner.

We do not propose at this moment to enter into the wide question of the value of the notched-bar impact test. There is, however, one property of structural materials which no engineer can any longer afford to ignore, and that is their power of enduring alternating stresses or "fatigue." Until recently it was a matter requiring something almost of the nature of a research experiment to make a determination of the fatigue range of a sample of material, and it was accordingly only quite rarely that such a test was used in engineering practice. On the other hand, it was thought that the fatigue range was substantially equivalent to the so-called "true elastic range," and that therefore a determination of the "elastic limit" should really give a better insight into the value of a given material than the ultimate strength. Efforts were accordingly made to introduce a determination of the elastic limit into practice; but the "elastic limit" here referred to is not that which is sometimes specified when in reality it is only the "yield point," or at most the occurrence of easily visible permanent set that is meant. Since a "yield point" in the true sense of that term occurs only in certain kinds of steel, a new term was introduced, sometimes called the "proof stress" or "proof load," this being a stress which the material is required to endure without showing more than a very small amount of permanent elongation, such as 0.005in. in a gauge length of two inches. Some purists have even gone so far as to require a much smaller amount of set than this and have demanded delicate extensometer measurements for the determination of the proof stress. Were the importance of the elastic limit as an index to fatigue strength borne out, there might be some justification for such an extreme requirement, but further research has shown that this connection is illusory. Not only is the "elastic limit" not a constant property of a given material, since it is found to depend to a very marked degree upon the past history of the actual piece under test, but it has been shown to have no specific relation to the fatigue range. Actually, of all the data obtainable from a tensile test, it would seem that the ultimate strength is the best guide to an estimate of fatigue resistance. The fatigue range—*i.e.*, the range of stress for which the material can endure an indefinite number of reversals without fracture—is found in most materials to lie in the vicinity of one-half the ultimate strength. In a few isolated cases values as low as 30 per cent. and in a few others as high as 58 per cent. have been found, but their relation to the "elastic limit" is liable to vary to a very much greater extent. Indeed, such metals as pure copper and "Armco" iron—a near approach to pure iron—show a fatigue range very considerably greater than their elastic limits. If we must rely upon the tensile test, therefore, the ultimate stress rather than the elastic limit or yield point should serve as criterion.

Fortunately, however, reliance upon the tensile test in cases where it is necessary to form an estimate of the fatigue range is no longer necessary, since modern research has provided at least one method—that developed by Gough at the National Physical Laboratory and fully described in our columns, see The Engineer, August 12th, 1921—whereby a rapid determination of the fatigue range by means of a test on a single test piece becomes possible. With such a test at their command, engineers have no need to guess at probable fatigue ranges, and no excuse for neglecting this vital factor in their designs. We do not know whether this form of fatigue test has yet been brought into what may be termed "workshop form," but if it has not, it is only for want of enterprise, since there is nothing about it which should make it more difficult to apply than a tensile test in which, say, a proof-stress determination is required. Of all the tests at our command, we still feel assured that the tensile test yields the most fundamental data, particularly if interpreted in the light of modern knowledge; but the tensile test can be so effectively supplemented by a fatigue test of this newer kind that it would be a pity if the practical value of a definite knowledge of the fatigue range were any longer ignored by engineers on the mistaken assumption that the test is too lengthy and difficult to perform.

Air Pollution in Towns of the United Kingdom.

By JOHN B. C. KERSHAW, F.I.C.

The eighth report of the Committee for the Investigation of Atmospheric Pollution, which has just appeared, deals with the observations made during the year ending March 31st, 1922, and is well worth the study of all interested in the movement for smoke abatement. The report is now published by the Meteorological Office, Air Ministry Department (Ref. No. M.O. 256), and can be obtained from H.M. Stationery Office.

The following subjects are dealt with:—(1) The results obtained with the standard gauge, collected and analysed month by month; (2) a new form of deposit gauge; (3) a note by Mr. J. Baxendell on the influence of a "nipher-shield" upon the deposit gauge; (4) a note by Dr. J. R. Ashworth upon the deposits obtained at Rochdale; (5) the records obtained with the Owen's type of automatic air filter; (6) a jet apparatus for the isolation and examination of atmospheric dust; (7) researches relating to obscurity and visibility of the atmosphere; (8) relations with other organisations.

The Standard Gauge Results.

Twelve authorities have taken part in the investigations carried on during the year ending March 31st, 1922, and thirty-one gauges have been maintained and operated in the following places:—Meteorological Office, London, one; City of London, one; County of London, six; Glasgow, nine; Birmingham, three; Rochdale, two; Southport, two; Kingston-upon-Hull, Liverpool, Malvern, Newcastle-on-Tyne, Rothamsted, St. Helens, and Stirling, one each. The figures in this last report are given in a new form, and in place of being expressed as metric tons per square kilometre, they are now given as metric tons per 100 square kilometres, in order to avoid the use of decimal places. Metric tons per 100 square kilometres, however, are also equivalent to grammes per square decametre; and the Committee states that as 10 m. are approximately equivalent to 33ft., which is the width of an ordinary narrow street, a square decametre is an area easily visualised. In order to convert the results to tons per square mile the factor .0256 must be employed.

The report contains a tremendous array of figures, and only those for total solids will be dealt with in this article. These figures are summarised, in rather different form from that used in the report, in Tables I., II., and III. below. The letters which are given in the fourth columns of Tables I. and II. represent the

Table I.—*Total Solids Collected in Fifteen Gauges in London and Glasgow, Expressed as Metric Tons per 100 Square Kilometres.*

Station.	5-year average.	Year 1921–22.	Classified. (1) 5-year average. (2) year 1921–22.	
			(1)	(2)
London:				
Meteorological Office	13,400	10,252	B	B
Golden Lane	15,311	13,958	B	B
Archbishop's Park	14,176	13,972	B	B
Finsbury Park	14,478	8,673	B	B
Ravenscourt Park	14,321	8,511	B	B
Southwark Park	19,178	12,680	C	B
Victoria Park	11,562	9,910	B	B
Wandsworth Common	8,882	10,788	B	B
Average	13,914	11,093	—	—
Glasgow:—				
Alexandra Park	11,988	8,936	B	B
Botanic Gardens	15,037	11,320	B	B
Queen's Park	11,079	8,105	B	B
Richmond Park	14,825	11,466	B	B
Rughill Park	12,442	9,761	B	B
Tollcross Park	14,106	10,300	B	B
Victoria Park	12,105	9,762	B	B
Average	13,083	9,950	—	—

Table II.—*Total Solids Collected in Gauges in Other Towns, Expressed as Metric Tons per 100 Square Kilometres.*

Town.	Average for 2, 3 or 4, years.	Year 1921–22.	Classification. (1) average (2) year 1921–22.	
			(1)	(2)
Rochdale	29,481	20,419	C	C
Newcastle-on-Tyne	23,482	21,343	C	C
Liverpool	22,431	21,912	C	C
St. Helens	18,297	15,117	C	B
Kingston-upon-Hull	16,023	16,008	B	B
Southport—				
Hesketh Park	7,897	7,971	B	B
Woodvale Moss	6,727	6,645	B	B
Rothamsted	5,069	7,213	A	B
Malvern	2,897	2,711	A	A

classification which was adopted in previous reports for showing the relative positions of the towns as regards atmospheric impurity. Thus, those marked with an A have a total solid deposit of less than 500 grammes per square decametre per month; B signifies a fall of 500 to 1500 grammes; C 1500 to 2500 grammes; and D 2500 grammes or above. It will be seen that only Malvern and Rothampsted come under classification A; the majority of towns come under B; while Rochdale, Newcastle and Liverpool have a C classification both for their average and for the results of the year ending March 31st, 1922.

The chief feature of the totals, however, is the remarkable cleanliness of the air of London and Glasgow compared with that of Rochdale, Newcastle, and Liverpool. This is more distinctly brought out in Table III., in which the comparative figures for the

Table III.—*Comparative Figures for the Total Solids, Calculated as Tons per Square Mile for a Series of Years.*

Town.	1914–15.	1915–16.	1916–17.	1917–18.	1920–21.	1921–22.
Rochdale	—	—	749	1069	763	522
Newcastle-on-Tyne	477	517	713	639	534	546
Liverpool	574	588	—	—	528	561
St. Helens	—	—	—	627	380	387
London (average)	342	451	427	431	304	284
Glasgow (average)	—	409	368	438	323	254
Rothamsted	—	—	—	—	129	184
Malvern	65	55	90	80	—	69

total solids—expressed in this case as tons per square mile—are given for a series of years. From this table it will be seen that Rochdale, which has headed the list for some time, is now third, and that Liverpool has the unenviable distinction of being the dirtiest town in which observations were made in the year 1921–22. Figures for Oldham, Bolton, and Birmingham, which all occupied high positions in the table in previous years, are not included in this eighth report.

London and Glasgow are seen to occupy comparatively low positions in Table III., and the Glasgow figures are specially remarkable, in that they show a great improvement in the atmosphere since 1918. It must, however, be noted that the year 1921–22 had a rainfall much below the average everywhere, and that the summer of that year was exceptionally fine. The miners' strike which occurred in the spring of 1921 also restricted the use of coal in April, May, and June for industrial purposes, and consequently the amount of solid pollution collected was much below the average. It would be wise, therefore, to wait for another year's returns before

deciding that Glasgow and London have really greatly improved their atmospheres since the returns of 1920–21. If one compares the general trend of the figures for deposit of solid impurity, however, in these two cities since the soot and dust fall observations were started, one must admit that they show distinct improvement since 1915. Discounting, therefore, the influence of the coal mining strike upon the 1921–22 results, one can well believe that the active work which has been carried on since 1912 by voluntary organisations and by the health authorities in Glasgow and London in connection with smoke abatement is beginning to bear fruit.

The Health Committees of Newcastle and Liverpool, on the other hand, cannot congratulate themselves upon any improvement in the cleanliness of their respective city atmospheres since the observations were commenced, and it would be wise for the health authorities of these two cities to devote a little more attention to the causes that have led to these high returns for atmospheric pollution.

Malvern, of course, stands in a class alone, and represents a standard of atmospheric cleanliness which other towns cannot hope at present to attain. But it must be observed that even in Malvern the air pollution rose during the war years to a much higher level than before. This increase was no doubt partly caused by the bad quality of the fuel supplied to the population for domestic purposes and partly to the drift of fine soot and ash particles from the industrial districts of the Midlands and South Wales. Dr. Owen's researches have proved that solid particles can be carried by air currents many miles over land and sea, and it is quite possible therefore for the smoke of these districts to reach Malvern with a favourable wind.

Table IV. gives the highest and lowest results for the various constitutents of the deposits, both for the general average and also for the 1921–22 returns.

TABLE IV.—*The Highest and Lowest Results for the General Yearly Averages, and for the Year* 1921–22.

Town.	General average.	Mean for 1921–22.
London :—		
Meteorological Office	—	Lowest sulphate
Golden Lane	—	Lowest tar, highest ammonia
Finsbury Park ..	—	Lowest sulphate
Southwark Park ..	Highest volatile salts	—
Wandsworth Com'n	Lowest rainfall	Lowest rainfall
Glasgow :—		
Richmond Park ..	—	Highest volatile salts
Ruchill Park	Highest rainfall	Highest rainfall
Kingston-upon-Hull	—	Highest soluble ash, highest sulphate
Liverpool..	Highest tar	Highest dust, highest deposit
Malvern	Lowest all elements except rain (tar not estimated)	Lowest all elements except rain (tar not estimated)
Newcastle-on-Tyne .	Highest carbon, highest dust, highest deposit	Highest tar, highest carbon
St. Helens	Highest soluble ash, highest chlorine	—
Southport	Lowest tar	Highest chlorine

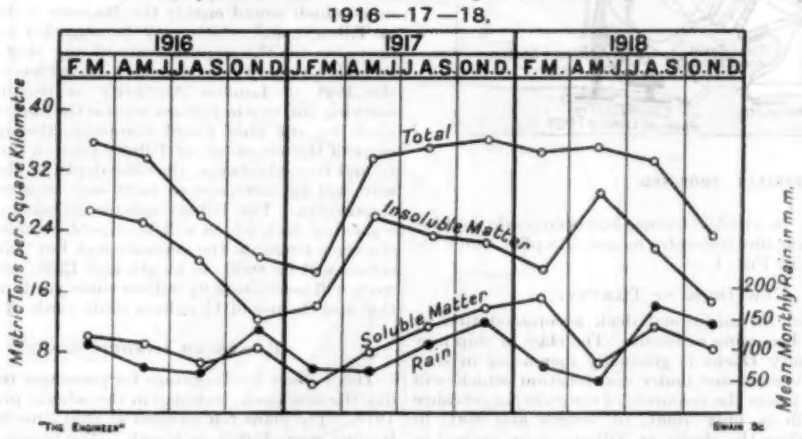
Liverpool, it will be observed, has the highest solid deposit and also the highest average for tarry matters, and this, in the writer's opinion, points to the chief cause of Liverpool's dirty atmosphere, namely, the shipping in her docks. At present shipping in dock is specially exempted from smoke prosecution under the existing law, and there is no doubt that much preventable smoke emission occurs when lighting up ships' boilers and getting ready for sea. The Liverpool soot and dust gauge is situated in Netherfield-road, in a position where the deposit is likely to be greatly affected by the smoke from the docks at the north end, and probably lower results would be obtained from gauges in other quarters of the city. Liverpool, in fact, ought to have four or six gauges installed in place of one; and, as stated above, it is time the health authorities of that city devoted some attention to the matter.

The Rochdale Results.

One of the most interesting sections of the report is the note by Dr. J. R. Ashworth upon the cause of the exceptionally high figures for deposits of solid carbonaceous and other matters which have been recorded at Rochdale. The analysis of the figures obtained in earlier years and the observations carried out with a "*twin gauge*," each half of which only functions when the wind is in a certain direction, are of considerable general interest and importance, and have helped to solve the problem of Rochdale's high soot and dust fall. Some extracts from his note are therefore given below.

Observations with a standard gauge have been made continuously in Rochdale since 1916 to the present time, with one interruption of nine months in 1919. The monthly observations of both insoluble and soluble matter are here grouped into quarters, and the general character of the whole can be traced in the accompanying engraving, which is a graph of the numerical results. The first point to be noticed is the seasonal variation which is exhibited by the total deposit, and more particularly by the insoluble matter. A second point is the close correspondence between the amount of soluble matter and the rainfall; and thirdly, there is evidence of an inverse relationship between the amounts of insoluble and soluble matter.

Rochdale. Mean monthly deposits in metric tons per square kilometre. Quarterly observations, 1916—17—18.



With regard to the first point, it will be seen from the diagram that high values of insoluble and total matter occur in the second or spring quarter, when rainfall and humidity are least, and low values in the fourth, or autumn quarter, when rainfall and humidity are greatest. The most probable explanation of this fluctuation is, that in the dry time of the year a good deal of dust is thrown into the air from the ground, while in the rainy season dust is prevented from rising by the moisture in and upon the ground.

A correspondence between the rainfall and the amount of soluble matter deposited has been found wherever observations have been taken, and an approximate formula giving a relation between these variables may be constructed, assuming a linear law—(see fourth report). Such a formula may be framed for both the soluble and insoluble deposits in Rochdale, and as the sum of these is the total deposit, a formula of this kind at once follows for the total deposit. If S, I, and T are the amounts of soluble, insoluble, and total matter respectively, in metric tons per square kilometre per month, and R is the rainfall in millimetres, then—

$$S = 5.7 + 0.027\,R,$$
$$I = 27.8 - 0.082\,R,$$
$$T = 33.5 - 0.055\,R.$$

These formulæ show that the soluble matter *increases* and the insoluble matter *diminishes* with the rainfall, but the latter at a greater rate, so that the total matter deposited, which is the sum of the two, must *diminish with the rainfall.*

With regard to the twin-gauge observations Dr. Ashworth makes the following remarks :—

"The twin gauge is placed at Roch Mills, a country station one mile to the west of Rochdale, at the boundary of the borough. On the east the town is shut in by the high chain of Pennine Hills, from which little or no pollution can come; but on the west it is flanked by a number of the populous manufacturing towns of South-East Lancashire, some of which are only a few miles away; Manchester itself, on the confines of the district, being at no greater distance than 10 miles. The position and construction of the twin gauge is such that one receiver collects all that is deposited with west winds which have passed over the manufacturing area of South-East Lancashire, and the other receiver collects what is brought with the east winds, which have passed over the town of Rochdale. The results given by this double gauge show that the high atmospheric deposit in Rochdale is not due to any large amount of impurities carried into the town by the west winds, such impurities being not more than 15 per cent. of the matter deposited at the centre of the town."

Summarising the results of the investigation, Dr. Ashworth states that in a *town area* there is a seasonal variation in the amount of deposited matter which coincides with the seasonal variation of humidity and rainfall; that the deposit is more in summer than in winter; and that the insoluble matter is greater than the soluble matter. These features are less prominent or are not found at all in country stations, and it may be concluded that dust in the air of the town, which would not be present in the air of the country, is the most probable explanation of the facts. It is found that in spite of the town of Rochdale being flanked by many other manufacturing towns, no large proportion of atmospheric pollution by weight finds its way into the town. And lastly, observations made during coal strikes and stoppages, coupled with the effects of good and bad trade, make it probable that in a manufacturing town such as Rochdale the greater part of the pollution arises from the factories and should therefore be capable of control by the town authorities.

If factory smoke were suppressed in Rochdale, Dr. Ashworth remarks, in conclusion, the deposit from the air would be reduced to about one-third of its present amount; that is, to about 10 metric tons per square kilometre, or 26 tons per square mile per month. The atmospheric pollution of the town would then be no worse than that of such commercial cities as London, and Hull, or even that of cities such as York and Exeter.

COAL DUST EXPLOSIONS.

The following account of the first of the experiments on coal dust explosions, which are being carried out at Eskmeals under the direction of Dr. Wheeler, is taken from the *Iron and Coal Trades Review.*

Coal dust (pulverised nut coal) was strewn on shelves and along the floor of the experimental gallery for a distance of 350ft. from the open end, at the rate of 1 lb. per linear foot, equivalent to 0.4 oz. per cubic foot of air space. The point of ignition was at the innermost end of the dust-strewn zone. The explosion was effected by firing a cannon placed inside the gallery, the charge consisting of 24 oz. of blasting powder, stemmed with 8in. of dry clay, the cannon having a 2in. bore. The mouth of the cannon pointed into a tube 3ft. in diameter and 12ft. long, open at both ends and lying on the floor of the gallery, and containing a concentration of coal dust of about 2 lb. per linear foot. No air current was employed during the explosion, and only one shot was fired. The gallery was set with pit props and bars and other underground appliances, there being one set of props and bars every 20ft. The coal dust was prepared by pulverising the coal in such manner that 85 per cent. would pass through a 200-mesh sieve. As a result of the explosion flame shot along the gallery and gushed from the open end to a considerable distance outside, being followed by gas fumes and heavy clouds of smoke, the pit timbers, tubs, &c., being flung about in various directions.

Later in the day, under similar conditions of ignition, the effect of a mixture coal dust and stone dust in equal parts by weight, both ground so that 85 per cent. would pass a 200-mesh sieve, was demonstrated. The effect of the stone dust admixture to the extent named was to considerably reduce the force and effect of the explosion.

BOOKS RECEIVED.

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American Petroleum Refining. By H. S. Bell. London: Constable and Co., 10–12, Orange-street, W.C. 2. Price 24s. net.

Die Gesetze zum Schutze des Gewerblichen Eigentums. By Dr. Erwin Hüttner. Reichenberg: Gebrüder Stiepel Gesellschaft.

The Ventilation of Public Buildings. By Robert Boyle. London: Robert Boyle and Son, 64, Holborn-viaduct, E.C. 1. Price 6s. net.

Industrial Furnaces, Vol. I. By W. Trinks. London: Chapman and Hall, Limited, 11, Henrietta-street, W.C. 2. Price 22s. 6d. net.

Mechanical Engineering Formulæ. By E. W. Huddy. London: E. and F. N. Spon, Limited, 57, Haymarket, S.W. 1. Price 4s. 6d. net.

Les Méthodes Modernes d'Organisation Industrielle. By M. L. Benoist. Paris: Gauthier-Villars et Cie., 55, Quai des Grands-Augustins. Price 18f.

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The Principal Factors in Freight Train Operating. By Philip Burtt. London: George Allen and Unwin, Limited, Ruskin House, 40, Museum-street, W.C. 1. Price 10s. 6d. net.

Diesel and Oil Engine Handbook. By Julius Rosbloom. U.S.A.: The Technical Publishing Company, Los Angeles, California. London: Chapman and Hall, Limited, 11, Henrietta-street, W.C. 2.

Port of London Improvements.

As the result of an arrangement made for financial aid from the Government, it has been decided by the Port of London Authority to proceed immediately with dock improvement schemes at Tilbury and elsewhere at a cost of £5,000,000. The greater part of this expenditure will be met by a loan from the Government of £4,300,000, which is to be lent for a period of thirty years at 3½ per cent. interest.

Much satisfaction has been expressed at the decision to put these works in hand without delay, as it will be one means by which the unemployment problem, which threatens to become acute during the winter months, may be minimised.

These new works comprise the following:—(1) A further development of the already extensive facilities for dealing with imported meat, at the Royal Victoria Docks; (2) a considerable extension of the Surrey Commercial Docks system; (3) the making of an entirely new dock, lock and dry dock at Tilbury; (4) the building of the much needed passenger landing stage at Tilbury, contiguous to the existing docks.

There is little that is entirely new in these projects, which in their main features were provided for in the scheme of improvements immediate, and prospective, which was under the consideration of the Port of London Authority in the year 1911. It was in the year 1909 that the Port of London Authority was created and its first effective act was to make a survey of the various dock undertakings, which had hitherto been in separate ownership, in order that their condition could be appraised and a programme of much needed developments formulated. This investigation resulted in the 1911 programme. It was realised that some of the works were of pressing importance, but that others, though eminently desirable, were not imperatively necessary at the moment. It was decided, therefore, to place the various schemes in three categories. The primary programme embraced all the works essential to bring the Port of London to the required standard of efficiency, so that it could provide adequately for the then needs of its users. The secondary programme consisted of works which it was believed would be necessary by the time the primary programme was completed, a period which was, of course, prolonged owing to the diversion of labour and materials while hostilities lasted. The third or contingent programme included other works the carrying out of which would be governed by the course of events. The primary programme, the whole of the works included in which, as well as portions of the secondary programme, were described in articles which appeared in THE ENGINEER in February, 1911, has been completed at a cost of £10,000,000.

The most important of these works is the Albert Dock extension, now known as the King George V. Dock, which was constructed at a cost of £4,000,000. Another important work is the cargo jetty at Tilbury, a two-storey structure 1000ft. long with a depth alongside of 30ft. at low water. At the West India Docks a new quay 2456ft. long, fitted with two-storey sheds, has been built on the north side of the import dock, and a second quay, 1600ft. long, has been provided on the north side of the export dock. New quays having a total length of 1834ft. have been constructed at the East India Dock. At the Victoria and Albert Docks a cold store, capable of storing 500,000 carcases of mutton, has been erected, and new pumping installations put in service for increasing the depth of water in the Victoria and Albert Docks. At the London Docks a jetty, 780ft. long and 190ft. wide, and a new quay, 1260ft. long, have been constructed. Shed and warehouse accommodation has been reinforced at all points, and the dredging of the river channels at a total cost of £750,000 has been steadily prosecuted. The engineer responsible for the design of these new works was Mr. F. Palmer, the then chief engineer to the Port of London Authority, and he indeed put forward a scheme for a new dock at Tilbury which was described in the articles in THE ENGINEER to which reference has been made, and his proposal was illustrated by means of a plan which we reproduce in Fig. 1.

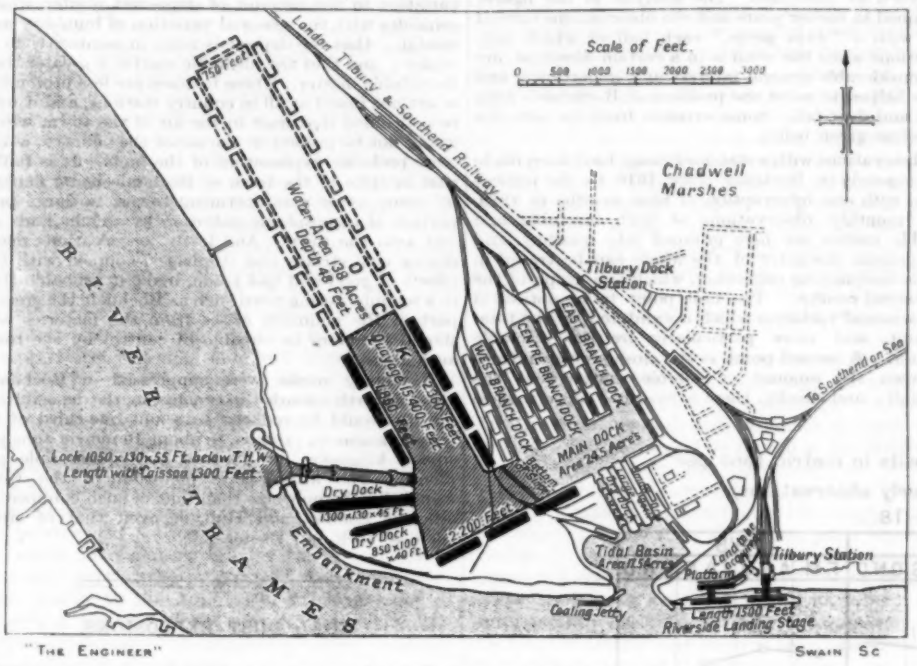
Scale of Feet
0 500 1000 1500 2000 2500 3000
London Tilbury & Southend Railway
Chadwell Marshes
Tilbury Dock Station
Water Area 38 Acres Depth 48 Feet
RIVER THAMES
K George V Dock 2,800 Feet x 1,000 Feet
EAST BRANCH DOCK
CENTRE BRANCH DOCK
WEST BRANCH DOCK
MAIN DOCK Area 24.5 Acres
To Southend on Sea
Lock 1050 x 130 x 55 Ft. below T.H.W. Length with Caisson 1300 Feet
Dry Dock 1300 x 130 x 45 Ft.
Dry Dock 850 x 100 x 40 Ft.
2,200 Feet
Tidal Basin Area 11 Acres
Land Ba... Platform
Tilbury Station
Embankment
Coaling Jetty
Length 1500 Feet Riverside Landing Stage
"THE ENGINEER"
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FIG. 1—NEW DOCK AT TILBURY AS ORIGINALLY PROPOSED

NEW DOCK AT TILBURY.

The need for additional dock accommodation at Tilbury is becoming insistent. The class of ship now using Tilbury Docks is gradually increasing in size, and new vessels are under construction which will tax to the limits the resources of the existing entrance lock, which is only 700ft. in length and 80ft. in width. When the docks at Tilbury were opened in 1886 the largest ship making use of the docks was the Orient, with a length of 485ft., a beam of 46ft., and a gross tonnage of 5385. To-day vessels with a length of over 650ft., a beam of 78ft., and a gross tonnage of over 24,000, have to be accommodated. It is not surprising, therefore, that the Port of London Authority has decided to carry out, in a modified form, the plans for an entirely new dock at Tilbury, which, as already stated, were first put forward by Mr. Palmer in 1911. That scheme was for an extension of the existing dock over a length of 1680ft. and the construction of a new entrance near Tilburyness. The proposed dimensions for the new entrance were 1050ft. in length, with an ultimate extension to 1300ft., the intention being to provide accommodation for vessels 1250ft. in length. The width of the entrance lock was to be 130ft., and the depth 55ft. below Trinity high water. Two dry docks were included in that scheme, one of the same dimensions as the entrance lock, and the other 850ft. long with a width of 100ft.

In the scheme which has now received approval—and a plan of which is shown in Fig. 2—a new dock will be constructed, with a water area of 115 acres, and provision is being made for a depth of 45ft., but only 40ft. in depth will be dredged in the first place. The full scheme makes provision for thirteen berths, but not all of them will be constructed until such time as traffic requirements justify the financial outlay. Six berths will constitute the first instalment. Careful consideration has been given to the site of the new entrance lock, and the position finally selected is in Northfleet Hope, nearly three-quarters of a mile above Tilburyness. At this point the width of the river from the pierhead of the new lock to the opposite bank will be 2900ft., giving ample room for manœuvring ships, and it is a further advantage that during almost the whole period of the flood tide there is slack water with a very slight ebb, so that locking in and out should be practicable at all states of the tide. The dimensions of the new entrance lock are 1150ft., or 100ft. longer than the entrance lock proposed by Mr. Palmer in 1911, but it has not been stated whether provision has been made for an extension to 1300ft., which was a feature of the earlier plan. The width of the new entrance lock is the same as that proposed by Mr. Palmer, 130ft., and the depth on the sill is to be 50ft. below Trinity high water. These are dimensions which would enable the Majestic to be docked at Tilbury, and which may be regarded as making provision for the requirements of any ship likely to be built for many years to come. What has influenced the Port of London Authority in deciding upon carrying out this important work is the announcement made by the Suez Canal Company, through which most of the vessels using Tilbury pass on the voyages to and from Australia, that the depth of that waterway will be increased to meet any requirements of shipowners. The Tilbury scheme includes, of course, a graving dock which will be capable of extension to the same length as the entrance lock but which at the outset will be 800ft. in length and 130ft. wide. The work will necessitate 9½ million cubic yards of excavation and the use of 1½ million cubic yards of concrete.

PASSENGER LANDING STAGE.

The Tilbury landing stage for passenger traffic was, like the new dock, included in the scheme proposed in 1911. The plans put forward at that time were for a landing stage 1500ft. in length. The present scheme, which will give passenger facilities that have long been required at Tilbury, is for a floating landing stage 2000ft. in length and 80ft. in width, with a depth of water alongside of 35ft. at L.W.O.S.T., which is to be built at the point shown on plan—Fig. 2—adjacent to the new railway station which is to be built by the London, Midland and Scottish Railway. An important feature will be a commodious customs and baggage hall, which will be constructed by the Port Authority. The details of the scheme suggest that every possible convenience will be provided to ensure

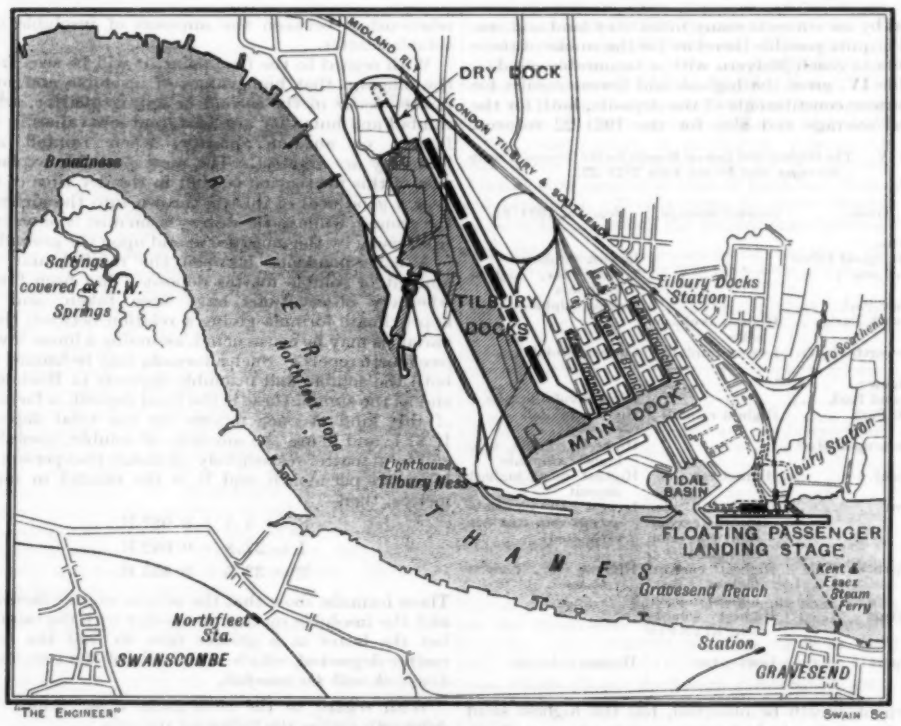


FIG. 2—NEW DOCK AT TILBURY AS IT IS TO BE CONSTRUCTED

the prompt landing and embarkation of passengers, and it is assumed that a special service of trains will be provided between Tilbury and London so that the journey will be completed within forty minutes.

SURREY DOCKS EXTENSION.

Another scheme which has now received approval is for the extension of the Surrey Docks, shown on the accompanying plan. At this part of the London dock system timber imports rank high in importance, and the docks were designed and have been developed to meet the special requirements of that branch of trade. The old method of handling timber was to discharge it into ponds for storage purposes. This practice is not now favoured, and in the new scheme of development some of the ponds will be filled up and utilised to much greater advantage. Almost the whole of the timber coming from the Baltic to the Port of London is discharged at the Surrey Docks, and in one year the imports from that source alone reached the high figure of 370,000 tons. Difficulty arises from the fact that arrivals are seasonal, and, consequently, congestion cannot be avoided unless additional facilities are provided. The plans which are now to be realised have been prepared after consultation with those engaged in the timber trade, from whom useful suggestions and advice have been received. It has been decided to form a new dock—the Surrey Commercial Dock, and negotiations are now in progress with the railway companies concerned, which it is hoped will result in the laying of railway lines into the Surrey Docks so that direct deliveries from shed to rail may be made. Tenders for part of the work at the Surrey Docks have already been received, and contracts are about to be placed. It is stated that the present works are only a portion of an extensive scheme of reconstruction which will follow in instalments at later periods.

NEW FROZEN MEAT DISCHARGING ARRANGEMENTS.

The new berth for the discharge of meat at the Royal Victoria Docks is the final item of the present improvement scheme. The Port Authority is now completing the equipment of a berth in the East India Docks for the discharge of chilled beef imported chiefly from the Argentine. This, however, will not meet all the requirements of the meat trade, and hence the decision to construct an additional berth, 620ft. long with a depth alongside of 28ft., at the Victoria Docks. This berth will be equipped with the most modern mechanical appliances for the rapid discharge of meat cargoes, and loading them into railway and road vehicles and insulated barges for transport to destination. A shed, 408ft. long by 95ft. wide with covered platforms, is included in the scheme for delivery to road and rail vehicles, and a smaller shed,

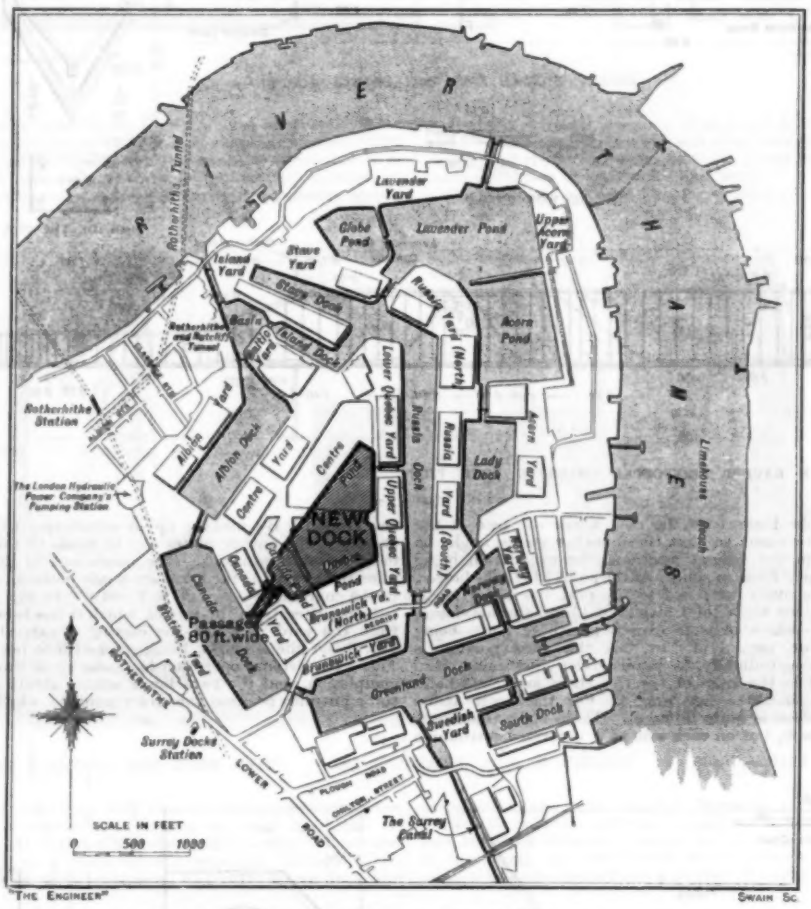


FIG. 3—SUGGESTED NEW DOCK IN THE SURREY DOCKS AREA

shown on Fig. 3—within the triangle now occupied by the Canada, Centre, and Quebec Bonds, which will enable five additional berths, each designed to accommodate ships 400ft. in length to be constructed. The walls of the dock will be carried down to a level which will permit of an ultimate depth of water of 35ft.; but for immediate requirements a depth of 27ft. is regarded as sufficient. The dock will communicate with the Canada Dock by means of a new passage 80ft. wide over which a bascule bridge will be built to give access to road vehicles. An improvement is also to be carried out in the older portion of the Surrey dock system where at present there is insufficient depth of water at neap tides for timber vessels to come alongside quays to discharge. This, of course, causes delay, and at times congestion. The remedy to be adopted is to provide a new impounding station, equipped with electrically-driven pumping machinery, by means of which the water will be permanently maintained at the level of spring tides. It is not, however, only in berthage that delay and congestion occur. To clear the timber rapidly from the quays after discharge requires more space than has hitherto been available. It is proposed, therefore, to add about 10 acres of covered storage. Attention is also being given to the question of the best type of mechanical equipment for the handling of timber, and as the result of a tour of inspection in Sweden by the general manager and chief engineer to the Port Authority, additional mechanical handling plant, based on Swedish practice, will be installed. Consideration is also being given to the question of railway communication, which has hitherto been lacking at 188ft. by 30ft., will be provided for barge traffic requirements.

CONCLUSION.

It is obvious that the carrying out of these works will require the purchase of a considerable area of land, although the Port Authority is the owner of some of the land upon which some of these developments will be made. The interesting feature of the land acquisition is that the authority is taking steps to purchase what is required under an order of the Ministry of Transport and the Acquisition of Land Act, passed in 1919, for the avowed purpose of saving public authorities from exploitation. With regard to the time in which the works for which contracts are about to be invited will be completed, it is estimated by Sir Cyril Kirkpatrick, chief engineer to the Port of London Authority, that the new Tilbury Dock will be completed within a period of five years and the bulk of the remainder of the programme in about 2½ years.

Lord Devonport, on the occasion when he made a public announcement on the subject of the new works last week, intimated the probability that he would have retired from the chairmanship of the Port of London Authority before any of the new projects are completed. It is fifteen years next March since he was appointed chairman of the Authority, so that he has been associated with all the improvements carried out since the year 1909, when the modernisation of the London dock system first received serious consideration.

Wreck Statistics for 1922.

THE statistical summary of vessels totally lost, broken up, condemned, &c., now published by Lloyd's Register, shows that during 1922 the gross reduction in the effective mercantile marine of the world amounted to 716 vessels of 887,812 tons, excluding all vessels of less than 100 tons. Of this total, 511 vessels of 743,866 tons were steamers and motor vessels, and 205 of 143,946 tons were sailing vessels. These figures exceed those for 1921 by 213,555 tons—steam and motor vessels 207,329 tons and sail 6226 tons. This excess is not due to actual casualties, the figures for which show a diminution of 64,115 tons, but entirely to the unusual number of vessels which have been broken up, dismantled, &c. The amount of tonnage so dealt with during 1922, viz., 371,101 tons, exceeds the figures reported in the Society's wreck returns for any year, being 6123 tons more than the total for 1910, which was the highest previously recorded. The tonnage of vessels, owned in Great Britain and Ireland, which were broken up, dismantled, &c., during 1922, amounts to 127,974 tons.

The number and tonnage of vessels of all nationalities lost, broken up, &c., during the last ten years are as follows:—

Year.	Steamers and motor vessels.		Sailing vessels.	
	No.	Tons (gross).	No.	Tons (net).
1913	371	533,002	294	184,028
1914	491	870,662	275	184,450
1915	992	1,893,718	316	223,398
1916	1,284	2,271,401	511	284,224
1917	2,605	6,607,261	748	520,206
1918	1,294	3,332,791	325	159,919
1919	425	524,172	241	112,658
1920	370	518,595	215	*138,959
1921	344	536,537	215	*137,720
1922	511	743,866	205	*143,946

* Gross tons.

War Losses Included in the Above Table.

Year.	Steamers and motor vessels.		Sailing vessels.	
	No.	Tons (gross).	No.	Tons (net).
1914	154	360,110	8	12,167
1915	659	1,380,657	67	57,516
1916	942	2,189,079	245	139,609
1917	2,211	5,957,913	523	392,449
1918	911	2,674,428	141	69,744

The statistical tables, which, it may be noted, have been prepared in such a manner as to facilitate comparison between the principal maritime countries of the world, exhibit interesting data as to the relative frequency of the different kinds of casualty, &c., which conclude the existence of vessels. Strandings and kindred casualties which are comprised under the term "wrecked" are the most prolific cause of disaster. To such casualties are attributable 46.1 per cent. of the losses of steamers and motor vessels, and nearly 41 per cent. of sailing vessels. Cases of abandoned, foundered and missing vessels are, no doubt, frequently more or less similar in the circumstances of loss; and, if these be taken collectively, they comprehend 27.1 per cent. of steamers and motor vessels and 34.8 per cent. of the sailing vessels removed from the mercantile marine during 1922 owing to casualty.

Of course, a large proportion of the tonnage annually removed from the merchant fleets of the world comes to what may be called a natural end, being broken up, dismantled, condemned, &c., for reasons not known to be consequent upon casualty or stress of weather. During 1922, the vessels so broken up, condemned, &c., amounted to no less than 42.3 per cent. of the steamers and motor vessels and nearly 39 per cent. of the sailing vessels included in the tables under review.

Table No. IV. shows the number and tonnage of steamers and motor vessels of all nationalities lost through marine and war casualties since 1902, exclusive of vessels broken up, condemned, &c., not in consequence of casualty or stress of weather. This table gives for each country the percentage lost of the total tonnage owned. Excluding the five war years 1914–18, the average percentage of loss of steamers and motor vessels belonging to Great Britain and Ireland during the remaining sixteen years amounts to less than 1 per cent. per annum of the tonnage owned.

BLAST FURNACE LABOUR-SAVING EQUIPMENT.

REDUCTION of the number of men at the stock-house from nineteen to three is one result of the new mechanical handling and labour-saving equipment installed by the Adrian Furnace Company at Dubois, U.S.A., in anticipation of the difficulties incident to labour shortage and increasing wages. A large oil storage yard or stock yard was established, served by a travelling bridge crane. From this yard extends a concrete trestle or viaduct for the transfer car which is loaded from the grab bucket of the bridge crane. This trestle is 500ft. long and 30ft. high. Beneath six of its 15ft. concrete girder spans are suspended steel plate bins or pockets for ore and fluxing stone. A row of segmental gates in the bottoms of the bins provides for charging the scale car, which is of steel and operated by electric motors under control of a man riding in a cab on the car. This man controls the travel of the car, the scale equipment, the bottom discharge doors and the bin gates. Coke, ore and stone are delivered directly to the furnace skip in a pit beneath the rails on which the scale car runs. Coke passes over screens, the fine material, or breeze, being discharged on to a belt conveyor and loaded directly into railway wagons. Instead of separate control of different operations there is now a tower for an operator who has direct electrical control of the skip cars, coke-bin gates, coke breeze conveyor, furnace bells and furnace gauging mechanism. The ore transfer car is 40ft. long, with a hopper 21ft. by 13ft., having a capacity of 50 tons.

The Ravier System of Sheet Piling.

In the description of the large electric generating station at Comines, which appeared in our issues of March 9th and 16th last, we mentioned the fact that the wall of the coal dock was formed of sheet piling carried out on the Ravier system. As this system of reinforced concrete sheet piling is a comparative novelty—at any rate, in this country—we think that the following information concerning it may be of interest to our readers.

The main difference between the Ravier wing piles and other types of reinforced concrete sheet piles is that the pile, instead of being of uniform section throughout is, for the major portion of its length, given the form of a T. With this shape the same resistance to bending is obtained with the use of considerably less concrete and steel in the body of the pile than is required in the case of plain slab piles; or, alternatively, with the same quantities of materials a pile of much greater strength results. The shape of the piles employed at Comines is shown in Fig. 1. It will be observed that for the bottom 5ft. 3in. or so of its length the pile is rectangular in cross section, measuring about 10in. by 6¾in. Above 5ft. 3in. the width rapidly widens out to about 5ft. 7in. The wings on each side of the T portion—which remains of the same width as that of the pile tongue, i.e., 6¾in. wide—are made just under 3¼in. thick. The T portion projects just over 18in. from the flat surface of the pile. The total length of the piles at Comines, including the tongue, is 8.5 m., or, say, 27ft. 10¼in. The top 7¾in., however, only measures 13¾in. by 6¾in., and forms the driving head. The winged portion of the pile is not driven very far into the ground. At Comines, for example, the pile is only driven to a total depth of 2.4 m., or, say, 7ft. 10¼in., and of that depth 5ft. 3in. is represented by the tongue. This is not a very great depth considering the nature of the subsoil existing in the locality. As explained in the article on the Comines Station, the maximum load which the ground in the vicinity of the electric power-house will take is 500 grammes per square centimetre, or rather under half a ton per square foot. As the depth before anything more solid is reached is considerable, it is quite evident that the piles cannot have been driven to refusal, nor is depth of insertion depended upon entirely for stability. A glance at Fig. 2 will show that at the rear of the wall two anchor struts—which have effective lengths of 3.5 m. and 6.0 m. respectively—are employed. The ground was excavated for a considerable distance to the rear where the face of the wall was to come, so that these anchor struts might be arranged in the desired positions, the excavation being subsequently filled in solid. At the point where the longer, or upper strut, is attached to the pile, the T portion is thickened out for a total height of 1½ m., the maximum thickness—which extends over a length of ¾ m.—being 0.28 m., or, say, 11in. In this thickened portion is formed, longitudinally, a parallel slot just under 4in. wide, and in the sides of the slot there are made holes 10½in. in diameter—see Fig. 3. For the lower struts the formation is quite different. There is no thickening of the T web, but on each side of it is formed a trunnion about 9½in. in diameter. These trunnions, which are formed by employing cylinders of expanded metal as reinforcement for the concrete, project about 5½in. from the face of the web. The anchor struts, which are, like the piles, of reinforced concrete, are shown in the drawing—Fig. 4. For the upper anchorage a single strut is employed, its head being inserted in the slot in the thickened web of the pile and secured there by means of a reinforced concrete pin. For the lower anchorage two struts are used, and they are made to embrace the web, the trunnions formed on either side of which enter the holes in the ends of the struts. At their landward ends the struts are formed with rectangular holes for the reception of the anchor plates which are of reinforced concrete, and which are shaped, as shown in the drawing at the right bottom corner of Fig. 3. The plates for the two lengths of anchor struts differ only very slightly in shape and dimensions. The drawing given represents that for the upper strut.

In driving the piles the lower struts are jointed to the piles before the driving is completed, and they are, at first, suspended by means of a cable which runs through a block attached to the pile-driving frame. The strut is allowed to fall with the pile as the latter is driven to its final position, and then, when the driving is finished, the strut is gradually lowered until the anchor plate rests freely on the ground. By making up or excavating the ground, therefore, the anchor plates can be made to take up the most suitable positions. The operations of driving the piles and of getting the lower strut into position, are shown in the engravings—Figs. 5, 6, 7 and 8. In Fig. 5 the pile is being lifted from the raft on which it has been brought from the yard in which the casting is carried out. In Fig. 6 the pile is shown being pitched into position. In Fig. 7 the driving operation has gone some way towards completion, and the twin lower anchor struts are about to be put into position over the trunnions, which are seen at the water line. The landward ends of the struts, which are fitted with their anchor plate, are seen resting on the raft which has floated them into position. In Fig. 8 the lower struts are seen embracing the web of the pile, their landward ends being supported so that the driving of the pile can be completed. In Fig. 9 is seen the process of fitting the upper struts into position, an operation which, in the case of the Comines wall, at any rate, was not begun until all the lower struts had been placed. It is explained that though at Comines there were but two struts for a height of wall of some 20ft. above the dredged level, by increasing the number of struts very much higher walls can be built on this system. There are various other methods of attaching the struts to the wing piles besides that employed at Comines and shown in our illustrations.

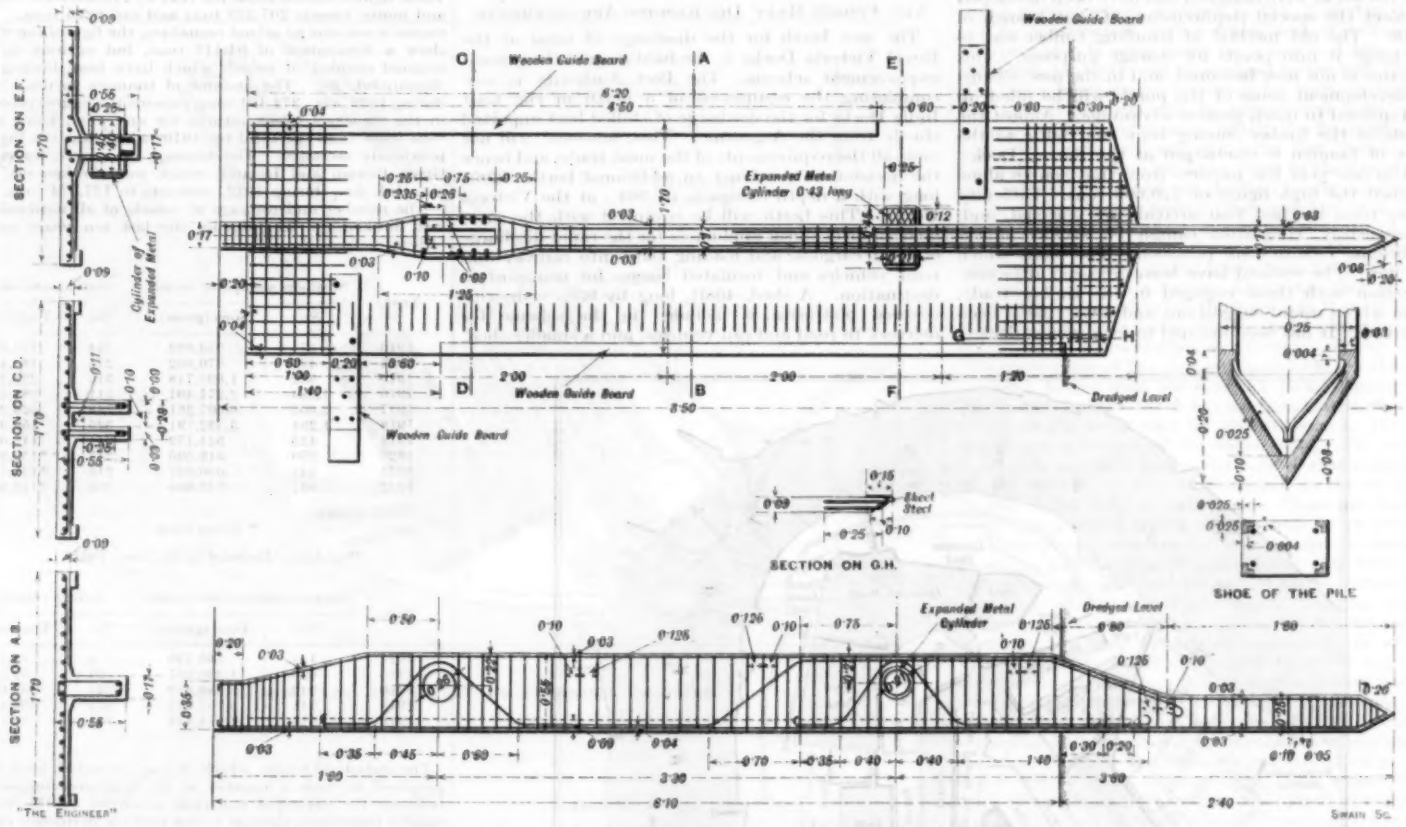


FIG. 1—THE RAVIER REINFORCED CONCRETE WING PILE

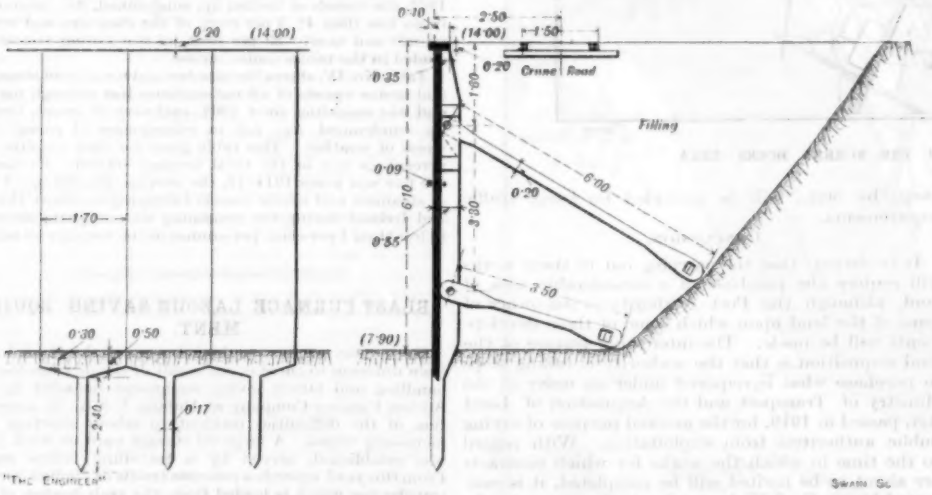


FIG. 2—DIAGRAM SHOWING ARRANGEMENT OF RAVIER WING PILES AND STRUTS

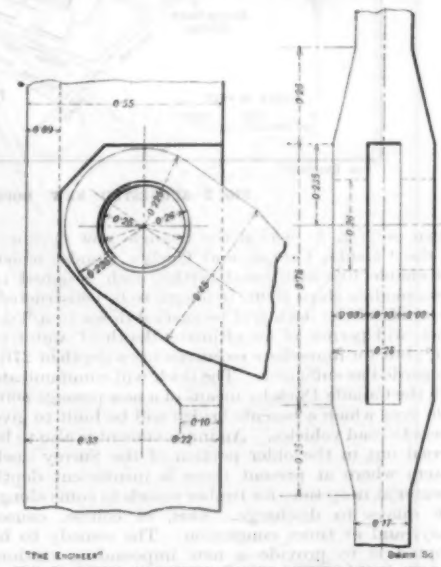


FIG. 3—JOINT BETWEEN UPPER STRUT AND PILE

When all the struts are in position the space at the back of the wall is filled in, a process which, besides helping to support the wall against the pressure of water outside, also securely holds the anchor plates in place. The filling material at Comines consisted of ashes, which were

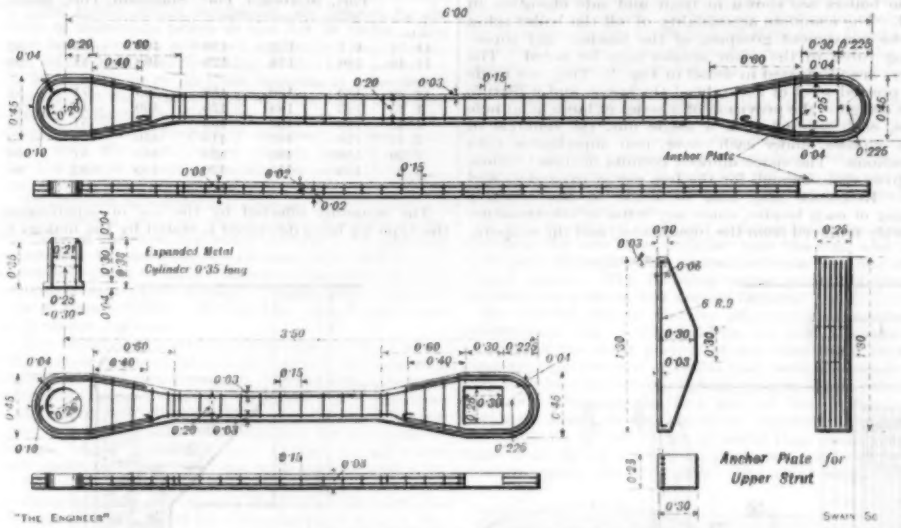


FIG. 4—ANCHOR STRUTS, PIN AND ANCHOR PLATES

chosen on account of their comparative lightness. When the subsoil is firmer than it is at Comines heavier filling material can be employed; but ashes or stones are to be preferred, when they are not too costly, because, on account of their lower specific gravity, the pressure against the wall is less than with heavier materials, so that the amount of cement and steel in the wall itself can be reduced. At Comines the struts and anchor plates were calculated to provide all the requisite resistance, the resistance of the portions of the piles driven into the ground being entirely disregarded. The total length of the quay wall at Comines is 125.6 m., or, say, 412ft.

We understand that this method of wall construction has also been employed where the bottom is of rock. In such case the wing pile is replaced by a member composed of panels having a vertical rib at the back, and without any tongue or point. The panels are arranged with their lower ends resting on the rock, and there is a device for holding up the panels forming the wall until the struts or ties have been got into position. Whether the piles have points or not, or whether they rest on a soft or a hard bottom, the inventor claims that in every case the system can show an economy of as much as 50 per cent. on the quantities of concrete and steel required by other methods of reinforced concrete sheet piling employed in the construction of quay walls and jetties.

The original inventor of the system of wing piles described in the foregoing was Monsieur L. Ravier, of Paris. He sold the rights of his patents in France to the late Monsieur Edmond Coignet, who assisted M. Ravier in improving the piles made in accordance with his method and who carried out a number of works in France, making use of these piles, with the result that the system became known in that country as the "Coignet-Ravier System of Sheet Piling." The ownership of the rights of the Ravier patents in this country is in the hands of Edmond Coignet, Limited, of 125, Gower-street, W.C. 1. On this side of the Channel the piles are usually referred to simply as Ravier wing piles.

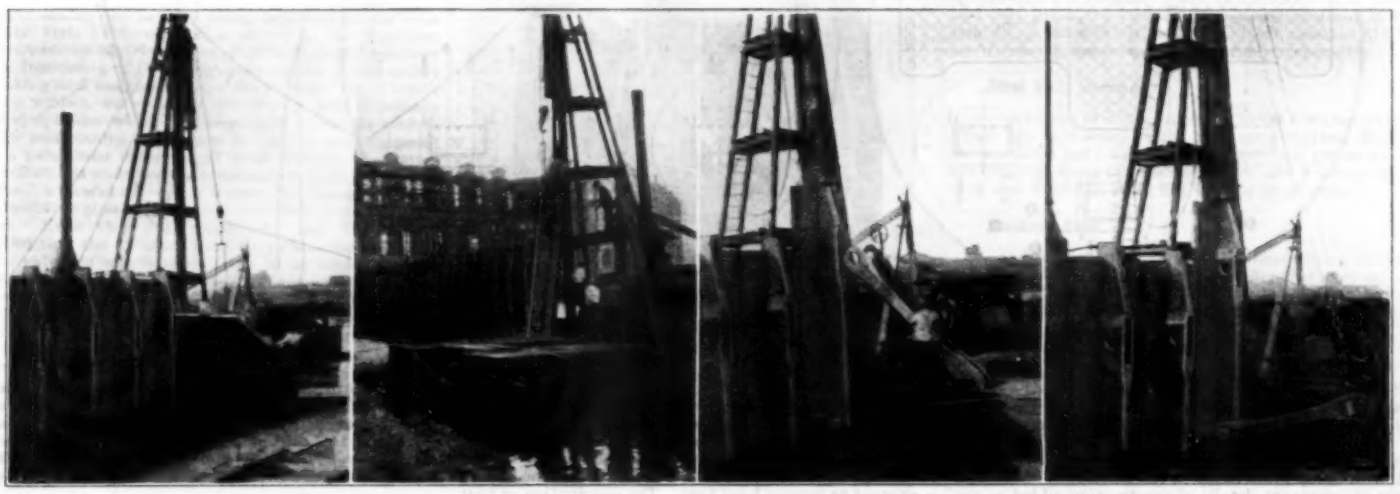


FIG. 5—LIFTING PILE FROM RAFT FIG. 6—PITCHING PILE IN POSITION FIG. 7—FIXING LOWER STRUTS FIG. 8—LOWER STRUT ATTACHED TO PILE

FIG. 9—FIXING UPPER ANCHOR STRUTS

NEW FRENCH WIRELESS REGULATIONS.

By the new French regulations for private wireless transmission and reception, receiving stations are divided into three categories: Stations installed by public bodies for the purpose of giving free lectures and concerts, &c.; private stations which give public concerts; and purely private receiving sets. Receiving sets must be registered at a post office, and a registration fee of 1f. will be charged; foreigners must obtain a special permit from the Under Secretariat for Posts and Telegraphs. Owners of private stations used for a public purpose must pay a yearly tax of 200f.

Special permits must be obtained for transmitting stations, which are divided into five categories: (1) Fixed stations for transmitting private communications; (2) fixed stations for transmitting communications of general interest; (3) movable stations corresponding with these two categories for the transmission of private news; (4) experimental and scientific stations; (5) stations belonging to amateurs. Everything transmitted by private transmitting stations comes under the law of 1850, regarding private telegraphic correspondence. Stations coming under the second category may only transmit artistic and educational matter and general news, having no personal character, all advertising being excluded. Information which has not a purely artistic, scientific, or educational character, can only be transmitted if it is to be published in a periodical fulfilling the conditions of the law of 1881, this publication not to free the owner of the transmitting station from responsibility for the information transmitted. Moreover, owners of stations coming within the second category must devote one hour daily to the transmission of news, both official and of general interest, communicated by the postal administration. They must keep a record of everything transmitted by their station.

The decree provides many regulations of a technical nature, including the wave lengths for the five different categories of transmitting stations, which are as follows:—(1) 150 m. to 200 m. for telegraphy and telephony; (2) 200 m. to 280 m. telegraphy, 200 m. to 230 m. and 350 m. to 425 m. telephony; (3) 150 m. to 180 m.; (4) variable according to aim in view; (5) 180 m. to 200 m. Special permission must be obtained to transmit messages in any other language than French. Private transmitting stations will be subject to a tax of 100f. per year per kilowatt, plus certain additional taxes. Permits may be revoked on many grounds, including that of divulging intercepted private messages to unauthorised persons.

NEW ELECTRIC POWER SCHEME FOR JOHANNESBURG.

HIS MAJESTY'S Senior Trade Commissioner in South Africa reports that the Johannesburg Town Council has now voted in favour of the proposed new power station and has advised its erection on the vacant site between the present powersta tion and Jeppe-street. It has also recommended that, in the period which must elapse before the new power station is completed, a 10,000-kilowatt generator adaptable to the new conditions should be installed in the old power station, on temporary foundations, to be afterwards removed to its permanent position in the new station, and that the matter should be treated as urgent, in order to have the set running before the winter of 1925. The total cost of the new station will be about £500,000; it will be equipped with two 10,000-kilowatt generators, together with two generators from the old station, so as to give a capacity of 39,000 kilowatts. Messrs. G. M. Clark and Partner have been appointed consulting engineers. The finance committee has also recommended the erection of this power station, provided that authority is obtained from the administrator to borrow an amount of £525,000.

OUR contemporary, the *Economist*, in its issue of the 28th ult., points out that the London and North-Eastern Railway Company issues the comparative figures with its traffic returns. If this can be done with the numerous amalgamations it has made it can be done by the other grouped companies. The publication of net as well as gross receipts is also asked for. This was done monthly in the Railway Working Statistics for the Ministry of Transport, and so could be done by the companies, but as they are under no obligation to issue particulars of these it is not likely that they will do so.

Uptake Superheater for Scotch Marine Boilers.

WITH the wider use of turbine machinery for marine propulsion, there has been, particularly since the end of the war, a marked revival of interest in superheaters and the use of superheat aboard ship. Although, however, the advantages of superheated steam and the economies resulting from its use are freely admitted, some marine engineers hold back from its adoption. Among reasons advanced in favour of a cautious policy with regard to superheat is the additional complication in the boiler arrangement, which often interferes with free access to boiler tubes, while, on the other hand, difficulties have occurred where parts of a superheater have been subjected to intense local heat.

With a view to meeting such objections, Mr. Thos. Sugden, managing director of T. Sugden, Limited, of 180, Fleet-street, London, has designed and placed on the market an improved type of uptake superheater for Scotch marine boilers, which we illustrate by the drawings, Figs. 1 and 2, accompanying this article. The firm, as is well known, has for long made superheaters for marine and land installations, and many of the features of the design consist of important details of construction added as the result of experience with various kinds of superheaters built for widely varying duties.

The design we illustrate was produced to meet the demand for a moderate degree of superheat—between 80 deg. to 100 deg. Fah.—with natural draught, and very satisfactory results, to which we shall refer later, have been given under sea-going conditions. The question of high superheat has also received attention, and we have seen another similar arrangement of uptake superheater with auxiliary oil firing, by means of which the makers hope to obtain results equal in every way to those given by any type of internal tube superheater. It is claimed, moreover, that with this design of uptake superheater the desired result is attained without interfering in any way with the efficiency of the boiler.

One of the chief objects of the designer has been the securing of a free boiler, accessible at all parts for examination, cleaning, and for expanding and replacing boiler tubes. The advantages of disposing the headers and tubes as shown will be appreciated, in that the arrangement greatly facilitates the ease with which repairs or emergency work may be done with the boiler under steam.

The details of the Sugden design as applied to two Scotch marine boilers are shown in front and side elevation in Fig. 1. The complete accessibility of all the boiler tubes and the convenient grouping of the headers and superheating tubes in the main uptake may be noted. The headers are illustrated in detail in Fig. 2. They are made from pressed steel of substantial thickness, and a feature of the design is the provision of a series of large hand hole covers, each secured with a single nut, the removal of which exposes, under each cover, four superheater tube connections. The space allowed permits of direct vision, and gives room enough for the free use of expanders and tools. Reference may also be made to the effective draining of each header, since any water of condensation is quickly removed from the superheater, and the evaporation of wet steam or priming water is reduced to a minimum. The headers and superheater tubes are supported and clipped in a simple and mechanical way, which permits the apparatus to be fitted to any existing boiler without necessitating elaborate structural alterations. A further advantage equally apparent is that no part of the system is exposed to intense local heat. The distribution of heat is so spread over the entire tube surface that no part of it is exposed to heat stresses. This claim made by the makers would appear to be substantiated by the reports which have been received from vessels so equipped, which indicate that it has not been necessary to renew or expand a single tube, even after years of service.

Some of the results of a superheating installation fitted in the steamship Muries, of the Monkseaton Steamship Company, Limited, which was constructed on the North-East Coast and ran her trials on April 21st last, are given below, with particulars of the vessel and its machinery equipment. Overall length, 245ft.; breadth, 37ft. 2in.; depth, 18ft. 3in.; deadweight tonnage at 17ft. 11½in. draught, 2600 tons; triple-expansion engines, having cylinders 19in., 31in., 51½in. by 33in. stroke, which developed on trial 1100 indicated horse-power when running at 82.6 revolutions per minute. The steam conditions as shown by gauge and thermometer readings were as follows:—

Time.	Boiler pressure.		Temperature of steam.		Superheat.	
	Port.	Starboard.	Port.	Starboard.	Port.	Starboard.
a.m.						
11.15	177	175	430	469	52	83
11.45	180	178	426	468	47	99
p.m.						
12.30	180	180	450	469	71	81
1.15	183	188	425	460	45	77
1.45	180	180	430	458	51	79
2.15	170	162	415	450	40	79
2.30	168	165	425	440	51	68
3.0	155	155	420	453	52	85

The economy effected by the use of superheaters of the type we have described is stated by the makers to be of the order of 16 per cent., which figure has been obtained by them from the actual performances of sister ships operating under exactly similar conditions on the same route. In the case of a larger 8000-ton vessel, we are informed that the coal consumption was reduced from 66 to 56 tons per day after superheating was introduced.

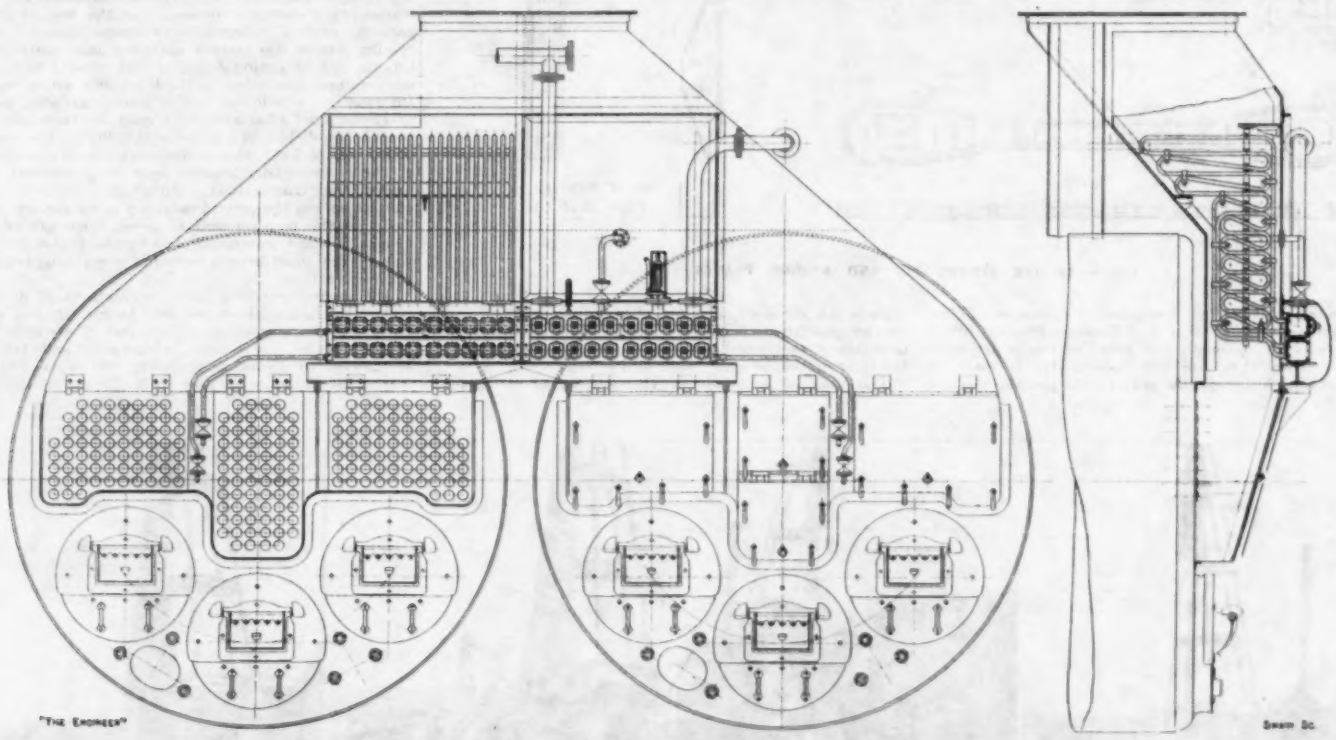


FIG. 1—THE SUGDEN MARINE-TYPE UPTAKE SUPERHEATER

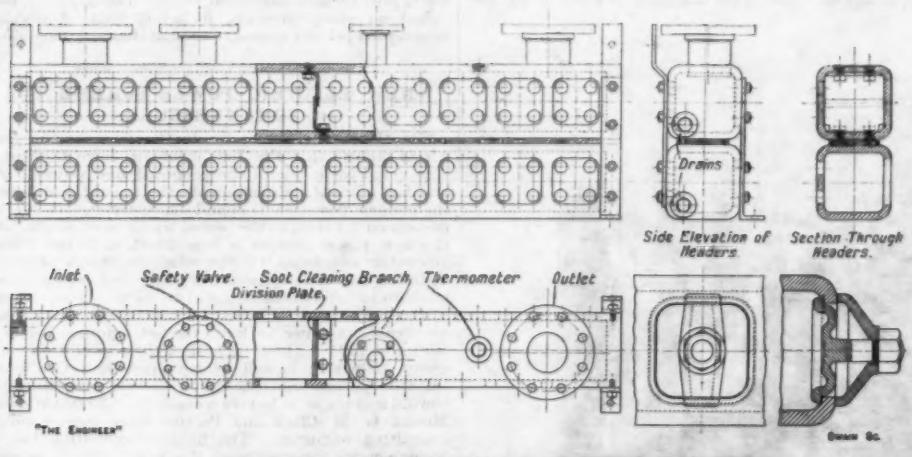


FIG. 2—ARRANGEMENT OF HEADERS FOR SUGDEN UPTAKE SUPERHEATER

The Minister of Transport and Electricity Supply.

THE following explanatory note and *résumé* of the report on his proceedings under the Electricity (Supply) Acts, 1882 to 1922, for the year April 1st, 1922, to March 31st, 1923, has just been issued by the Minister of Transport.

1.—Under the Electricity (Supply) Act, 1919, the powers and duties of the Board of Trade with regard to electricity were transferred to the Minister of Transport, and provision was made for the appointment of the Electricity Commissioners, who were to be responsible to the Minister. Under the existing arrangements electricity undertakings obtain powers by means of an Act or Order to supply in a given area. These undertakings are mostly small and disconnected. In order to improve the conditions of supply the Commissioners provisionally determined certain electricity districts, in which it might be possible, by the appointment of Joint Electricity Authorities, to group the various isolated undertakings, thus giving greater freedom in the generating and supply of current. Having determined the areas, the Commissioners next turned to the preparation of schemes which could be embodied in an Order and thus lead to the actual constitution of the areas and the appointment of the Joint Authorities.

During the past year two Orders were made and presented to the Minister for confirmation. These Orders were:—

(*a*) The South-West Midlands Electricity District Order, 1922, constituting the South-West Midlands Electricity District and establishing the South-West Midlands Advisory Joint Committee.

(*b*) The South-East Lancashire Electricity District Order, 1923, constituting the South-East Lancashire Electricity District and establishing the South-East Lancashire Electricity Advisory Board.

Both Orders were confirmed by the Minister and subsequently approved by resolution of Parliament. These are the first two Orders under Section 7 of the Electricity (Supply) Act, 1919. The position as regards the remaining districts is set out in the appendix to the report.

2.—Meanwhile, in order that the procedure by which undertakers could obtain powers might be simplified, the Act of 1919 provided for the making of Special Orders by the Electricity Commissioners, to be confirmed by the

Minister and subsequently approved by resolution of Parliament. During the year in question the Minister confirmed thirty-four Special Orders, giving powers of various sorts to the undertakings who had applied. Two further Orders were confirmed for the supply of electricity in bulk.

3.—The charging powers of electricity undertakings, as of other public utility companies, are limited by the insertion of maximum prices in the Act or Order. The Minister has, however, power on application being made to him, either by the undertaking or the local authority or the consumers, to revise these maxima at intervals of three years. At the present time, with the value of money continuing to fluctuate, this duty becomes one of great importance, and it is frequently necessary to hold local inquiries into the facts before Orders can be issued. During the year in question the Minister made thirty-five Orders revising charging powers.

4.—In addition to controlling charges, the Minister has various duties laid upon him with a view to ensuring public safety. One of the most important of these is the granting of consents to the erection of overhead lines, which consents are only given when the Minister is satisfied that the requirements as regards strength, height above ground, &c., have been fulfilled. During the year consent was given in ninety-one cases.

5.—The erection of overhead lines also involves other questions, such as amenities and the rights of the company to wayleaves over private property. Where disputes arise on these points, application may be made to the Minister, who can, if necessary, make an Order after inquiry. During the year six applications were received for consents to wayleaves. After holding a local inquiry for each the Minister gave his consent in four cases and refused it in one. The sixth application was withdrawn.

6.—Paragraphs 25 and onward deal in outline with the proceedings of the Electricity Commissioners during the period under review. The Commissioners will in due course issue a fuller report of their own proceedings.

The Minister of Transport's report may be obtained from H.M. Stationery Office, price 9d.

SIXTY YEARS AGO.

CHIEF among the articles which appeared in our issue of July 31st, 1863, we find a report to the Egyptian Government by Mr. Hawkshaw, F.R.S., then the president of the Institution of Civil Engineers, on the practicability of making and maintaining the Suez Canal. In a leader on the subject we reviewed the widely and hopelessly divided opinions which had been held as to the success of this undertaking. Previous to 1847 it was supposed that a permanent difference of level between the waters of the Red Sea and the Mediterranean existed, and it was not until a careful survey by Robert Stephenson and two continental engineers was made that this error was dispelled. Even then Mr. Stephenson and M. Talabot reported that the absence of a current and the character of the entrance which would have to be made into the Mediterranean made the whole scheme of an inter-marine ship canal altogether impracticable. Mr. Hawkshaw's conclusions, that "as regards engineering construction there were no works on the canal presenting on their face any unusual difficulty," and his opinion that "as regards the maintenance of the canal no obstacles would be met with that would prevent the work, when completed, being maintained with ease and efficiency without incurring any extraordinary or unusual yearly expenses," were confirmed by the construction of the canal and its successful working. One of the minor difficulties we commented upon was the navigation of sailing vessels at the canal entrances. We were careful to point out that before long steam propulsion of vessels would predominate. It was estimated that the completion of the canal scheme would cost £8,000,000, but no reference was made to its proving a commercial and revenue-producing undertaking. Another leader bearing on an article reprinted from *The Times* has the interesting title of "Railway Imprisonment," and compares the lot of railway passengers of that day who voluntarily subjected themselves to imprisonment in the close cells of railway carriages as worse than that of the involuntary prisoners at Pentonville. This was before the day of corridor coaches, and we strongly urged the introduction of the emergency signal cord communicating each carriage with the guard and driver of the train. Apparently this arrangement was already in vogue on American and some continental railways, but at the time we wrote it had not been introduced on to British railways for the service of passengers, although a similar system was in use to some extent on the South-Eastern Railway as a means of signalling between the guard and the driver of a train. The subject of steam fire-engines was prominent in the issue with which we are dealing, and a new 30 cwt. engine, the Sutherland, by Merryweather, is illustrated; while a paragraph deals with the public trials of an American Manhatten fire-engine, which was tested with qualified success at Shadwell entrance to the London Docks. Comparisons were made between the Gwynne pump and the Carey pump, with which the American engine was fitted. An account was given of the working of an experimental pneumatic despatch tube, 600 yards in length, which was laid between Euston Station and the District Post Office in Eversholt-street. During about six months' service thirty trains per day—excluding Sundays—were despatched, the time of transmission occupying seventy seconds, with a daily cost of £1 4s. 5d. The scheme to lay a main tube 54in. in diameter from Euston Station to the General Post Office in St. Martins-le-Grand and forward to Gresham-street was also mentioned.

ATTENTION was drawn in Parliament on July 24th to the anomalies that exist by isolated railways of one group being found in the midst of the system of another group. Colonel Ashley pointed out, in reply, that under Sec. 18 of the Railways Act the Ministry of Transport could confirm agreements for the purchase, lease, or working by one company of part of the system of another company.

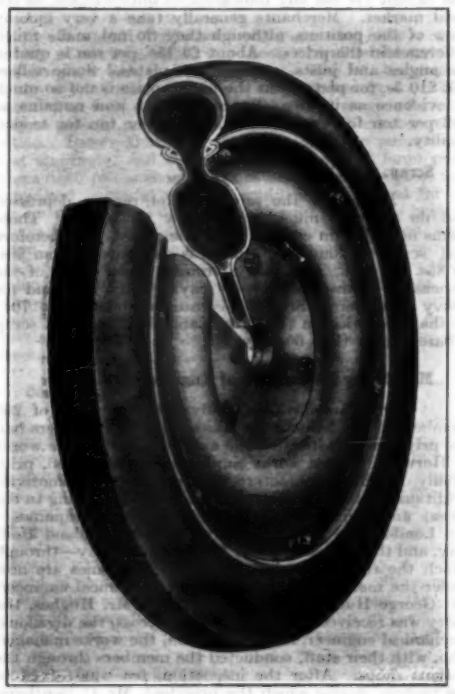
A Pneumatic Road Wheel.

WE recently had an opportunity of investigating a form of pneumatic tire and wheel, for road vehicles, that appears to us to possess several novel and valuable features. This wheel, of which we give an illustration below, is the invention of Mr. L. Nuttall, of High-road, Goodmayes, and is the result of an endeavour to combine the good features of a large pneumatic tire with the cost of normal equipment.

As will be readily grasped from the illustration, a special form of wheel is adopted by the inventor, and it is so formed that there is a considerable annular cavity between its two pressed steel sides, just within the rim. A normal outer cover is used for the tire, but the inner tube is made sufficiently large to fill the cover and the cavity in the wheel also.

It will be noticed that half a dozen bolts are used for clamping the two discs together near the rim, and these bolts pass through tubes vulcanised into the tube at the proper places. The inflating valve protrudes through the wheel in more or less normal fashion.

Mr. Nuttall claims that by adopting this method of construction, the vertical load on the tire is transmitted directly to the inner portion of the wheel, and that the discs are thus relieved of radial load, with the result that they may be considerably lighter than would be otherwise possible. Although the first part of this contention is obviously sound, it appears to us, however, that against the reduction in the weight of metal thus made possible, there must be set the bursting stresses produced by the pressure within the tire tube. The total weight of the



THE NUTTALL PNEUMATIC WHEEL

wheel is, nevertheless, only some 10 lb. greater than that of a standard type.

The principal advantage of the new arrangement naturally lies in the increased air capacity. It is possible to use, for instance, a 9in. inner tube with a 3½in. cover, and although the increased air capacity is naturally not so great as that represented by the difference between these two diameters, on account of the figure-of-eight shape, the capacity is at least doubled, as compared with standard practice. This increase in air capacity, which must improve the shock-absorbing qualities of the wheel, is attained without adding to the cost of the outer cover in the least, while the extra cost for the tube is insignificant. With the wheel discs made of pressed steel, the wheel itself is no more costly than one of the artillery type.

In the case of the wheels which we have inspected, the discs are made of aluminium alloy castings about ¼in. thick, but they are now being pressed from No. 16 gauge steel. The two discs are held together by six bolts round the circumference and three nearer the centre, while three other bolts are used for fixing the wheel on to its axle. If the first-mentioned nine bolts are undone, the outer disc can be lifted straight off, when the outer cover can be removed and the inner tube is exposed.

We have made some short runs on a car fitted with these new wheels and were very favourably impressed with the smoothness of the riding, while the outer covers were in better condition than one would have expected, with standard wheels, after the mileage recorded on the speedometer. This latter fact may, it seems to us, be accounted for, to some extent, by the facilities which the metal wheel discs offer for the dissipation of heat generated within the tire.

Two of the railway groups have announced distinctive colours for their rolling stock. The colours of the companies are expected to be:—Great Western: Locomotives, green and black; carriages, Windsor brown with cream upper panels. London and North-Eastern Railway: Locomotives, passenger green, goods black; carriages, varnished teak. Southern Railway: Sage green for the carriages, and yellow engines. London, Midland and Scottish Railway: Caledonian yellow.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Market Conditions.

THE holiday spirit predominated at the weekly meeting on Birmingham Exchange to-day—Thursday. There was only a small attendance, and little business was transacted. The tone of the market was hardly so pessimistic as of late, and in one or two directions improvement was reported. This was most noticeable in the sheet iron department, where makers have found it possible, not only to stem the tide of falling values, but also to increase their basis price by as much as 10s. per ton. In other branches of the Midland iron and steel trade, the weakness of prices continues. Supply exceeds demand and values, as a result, are irregular and to a large extent precarious. Consumers continue to press for reduced quotations, and it is obvious that they are of opinion that, despite recent concessions, bottom has not been touched. Both iron and steel masters have had to concede further reductions even to secure the small tonnage orders which consumers have to give out to satisfy their immediate needs.

Galvanised Sheets Recover.

Sheet iron prices are the only ones which are not moving downward. There has been a sharp rally in galvanised sheets, prices of which had dropped steadily for some time past, as a result of the abstention from buying by the principal overseas markets. It appears that such abstention was, as I intimated in a recent letter, not altogether attributable to a collapse of consumptive demand. If it is to be so interpreted, either the present price movement is artificial or requirements have expanded in some of the centres of the trade as quickly as they contracted. Millowners who recently were willing to sell at £17 15s., have by two stages of 5s. advanced their quotations to £18 5s., both for home and export, and this would appear to be the present minimum. Some makers are demanding £18 10s. They can now see themselves safely through August, which is usually a dull month, and rely upon the customary seasonal demand in September. A fair sale is in progress of black sheets at £13 10s., for which the motor trades are largely responsible.

Steel Strip Reduced.

Owing in a great measure to the keen competition which has held sway in the steel strip market, Staffordshire makers have this week reduced their prices by 10s. per ton, viz., from £12 15s. to £12 for best welding conduit strip and from £12 5s. to £11 15s. for hinge strip.

Finished Steel.

Steel is a poor market, business having dwindled to a low ebb. The competition for finished steel is, however, hardly so keen as it was, and it is considered significant that the Middlesbrough houses generally have declined to supply steel to this district on the £9 15s. basis lately adopted by the Midland steel works. The question of railway rates enters largely into this refusal, and the position of local steel makers has been strengthened accordingly. Very little continental finished steel is on offer, and some sellers seeking business have invited applications as to price. Home prices continue to weaken and Staffordshire steel hoops are now down to £12, showing a fall of 10s. per ton on recent figures. Small bars are still procurable at from £9 15s. to £10, and ship, bridge and tank plates from £10 5s. upwards. There is still almost an absence of new orders for constructional material, for while the local builders of rolling stock have good contracts on hand, the amount of new business coming from the home railways is not large. Indeed, it would appear that the various companies are determined to hold up their new undertakings and rolling stock renewals pending still lower material prices.

Semi-finished Steel.

Reduced competition from the Continent is helping to stabilise the semi-finished steel market. It is still possible to buy here and there spot lots of continental material at £7 10s., but the usual quotation is very nearly the same as that of native producers, viz., £7 15s. to £18. Home producers are receiving slightly better orders, and report inquiry as having much improved during the past week. A certain proportion of Belgian billets is still coming into this district, though new orders are going to the local firms, for, prices being equal, the delay in delivery of continental material and the fact that cash terms are often stipulated, weigh heavily against the foreigner.

Scrap.

The scrap market is still strongly affected by competition from Belgium and Germany, but recently there has been slightly more inquiry for this material. Buyers and sellers are, however, at variance with regard to prices, and though £4 is quoted business generally is passing at a figure round about £3 15s.

Pig Iron.

The market for pig iron continues to weaken, and competition for the meagre amount of business offering is keen. Northamptonshire No. 3 foundry pig can now be bought at 1s. 6d. to 2s. 6d. below the £4 17s. 6d. quotation of a week ago. Apart from a few special sales in the neighbourhood of £4 15s., Derbyshire smelters are firm in their quotation of £4 17s. 6d. This price, however, is higher than consumers are prepared to pay, unless in the case of small accommodation supplies. Some furnace owners, unhappily, have decided to damp down their furnaces, and already two have suspended production in North Staffordshire and one in Derbyshire. At least two others, I understand, are likely to be put out of commission shortly. Owners are reluctant to take this step,

but they say it is preferable to working at a loss. Fuel prices for the moment are slightly easier, though this is not expected to continue, in view of the renewed continental demand, which has already brought about a rise of 1s. per ton in the Middlesbrough area.

Manufactured Iron.

The Staffordshire iron mills continue badly off for work, and extended holidays are expected where plant continues to be employed. Prices are weak and irregular. Marked bars alone have maintained an unbroken basis, and in spite of the disparity between ordinary and best iron, these bars continue at £14 10s. Unmarked bars are on the £12 basis. Good merchant quality bars can be bought for £11 10s. up to £11 15s., and the average selling price of bars for the nut and bolt trade is £11. Nut and bolt makers continue to work far below productive capacity, but when they require material they usually approach continental sellers, for there is still a wide disparity in the prices of native and Belgian bars suitable for this trade, notwithstanding the recent advance in continental quotations. No 3 Belgian bars cannot now be bought for delivery in this district under £9 5s., but supplies are coming in which were bought at prices substantially below that figure. South Staffordshire and Lancashire makers are fighting for the small orders for special qualities and sizes.

Heavy Edge Tools.

Trade has gone rather flat again in the local heavy edge tool industry. Though inquiries are stated to have improved, actual orders have fallen off, and this in spite of the fact that makers recently took advantage of an easement in iron prices to cut their own quotations slightly. Foreign buyers are holding off, presumably in the hope of further cuts, but producers do not hold out much prospect of such a course, stating that prices are now on rock bottom.

Pressure Gauge Glasses.

Birmingham has at least one really active industry at the moment—that which has to do with the manufacture of pressure gauge glass. Manufacturers have been working overtime for some twelve months, and there is no indication that demand is being overtaken. The activity is largely on export account, the distant parts of the Empire being among the best customers.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Outlook.

THERE is no sign of relief yet in the dullness of the markets in this district. The general downward tendency in iron and steel is discouraging consumers, and very few are now willing to give out orders. It is true that there is not the same tendency in the non-ferrous metals, but it has to be remembered that these are a long way nearer to the pre-war levels than are iron and steel. The memory of the trade is apt to be short, and it is as well to be reminded that average prices for pig iron before 1914 were from 50s. to 60s. per ton, for steel billets 80s. to 90s., and for bar iron and bar steel £7 to £8 per ton. Whether we shall get back to these levels within any reasonable time may perhaps be doubted, but it is obvious that iron and steel are not in so safe a position as copper, tin and spelter.

Metals.

Although copper is fairly cheap and has shown some inclination to improvement lately, it is curious that merchants take a very unfavourable view of the future. It is not easy to believe that standard copper can become very much cheaper, and yet neither merchants nor consumers are disposed to buy very much ahead of immediate requirements. Possibly the chaotic condition of the Continent may be the deterrent, and, of course, it is very difficult to see how continental industries can be restored until the currencies are put into some kind of order. There seems to be an endeavour now in American copper circles to spread the idea that stocks of copper are low, and that a revival of industrial buying is bound to come on very soon. How far this is in the nature of trade propaganda and how far it is based upon fact, it is difficult to decide; but perhaps it is not safe to ignore it altogether. That stocks of copper in America are lower than they were at the opening of the year is generally admitted; but, on the other hand, the capacity for production is very large, and the power of Europe to buy copper from America is reduced. The situation is certainly perplexing, but one does not see that copper is a very risky article to buy at the present prices. The prices for manufactured copper and brass remain as they were, and there is no indication that any attempt is to be made to bring them into better relation with the market for standard copper. Tin has been an improved market, and there was some increase in American buying, which caused a sharp rise at one time; but sentiment here did not appear favourable, and when the buying ceased or fell off the market seemed to have no inherent strength. Of course, in a market like tin, it is possible, and even frequent, that fluctuations up to £10 one way or the other will take place; but experts seem to think that any prolonged upward movement is improbable at present.

Lead and Spelter.

The firmness in the lead and spelter markets continues. So far as immediate deliveries of lead are concerned, the dockers' strike has caused rather a short supply. A question of interest is whether the market may not be overburdened with lead when the steamers now awaiting discharge are unloaded. Spelter has also been affected, and the price for prompt metal went over £31 per ton. This price has not been seen since the end of May. The demand from the galvanising trade is better, but the brass trade is not consuming a great deal.

Pig Iron.

The markets in Manchester for foundry iron are still very dull and weak. Makers in the Midlands are struggling to keep values up; but it is fairly obvious that the struggle can end only in one way, unless a very drastic reduction of output should occur. This policy may be adopted by the Midland furnaces during the next two or three months, and in that case consumers here may be in error when they assume that the value of foundry iron must soon come back to the figures of last January. The consumption here is small, and the buying being done is mainly for small lots to supply current requirements. There is no disposition to buy even three months ahead, and it is generally understood that were there any such disposition merchants could quote prices considerably below those which are supposed to be makers' prices to-day. One is a little uncertain what these latter prices are. As a rule, sellers of Derbyshire No. 3 pig iron base the Manchester price on 97s. 6d. at the furnaces; but it is believed that 95s. would be accepted. This is still 12s. 6d. to 15s. per ton above the January prices—what might perhaps be called the "pre-Ruhr prices"—and hence the market has a good way to go before consumers can be satisfied.

Finished Material.

Although there are reports to the effect that the export markets for manufactured steel are rather more lively, or at any rate that there are more inquiries about, one cannot yet see any indication of improvement in the local market. Merchants generally take a very gloomy view of the position, although they do not make much difference in the prices. About £9 15s. per ton is quoted for angles and joists, and £10 for plates. Some sellers ask £10 5s. for plates, but the higher price is not so much in evidence as it was. Lancashire bar iron remains at £12 per ton for Crown and £11 15s. per ton for second quality.

Scrap.

Dealers in the scrap market remain depressed and do not find much opportunity for selling. There seems no object in cutting down the prices, and therefore cast scrap for foundry purposes is still quoted from 80s. to 85s. per ton. For heavy wrought scrap many of the Lancashire ironworks are now paying only 75s., and for heavy steel scrap Sheffield consumers offer only 70s., so that the price on trucks in Lancashire for steel scrap is barely more than 60s. per ton.

Manchester Association of Engineers.

On Thursday last, July 26th, upwards of 200 members of the Manchester Association of Engineers had the privilege of inspecting the extensive locomotive works at Horwich. These works employ about 4000 men, principally in the manufacture and repair of locomotives. Additional interest was attached to the visit owing to the recent amalgamation of the three railway companies—the London and North-Western Railway, Midland Railway, and the Lancashire and Yorkshire Railway—through which the respective works of these companies are now under the management of the chief mechanical engineer, Mr. George Hughes. In the absence of Mr. Hughes, the party was received by Mr. G. N. Shawcross, the divisional mechanical engineer, and Mr. Gibson, the works manager, who, with their staff, conducted the members through the various shops. After the inspection, tea was served to the visitors, during which the president, Mr. C. Bentham, after expressing his thanks for the privilege afforded, referred to the possible changes in locomotive design and workshop practice which might be brought about through the recent amalgamation. The visit was a great success and thoroughly enjoyed by those present.

BARROW-IN-FURNESS, Thursday.

Hematites.

The depression in the hematite pig iron trade of this district is still marked, and at present there are no signs of improvement. Business is quiet all round, and there is no disposition on the part of consumers to place orders for iron beyond the covering of their immediate wants. Fair orders are held at most of the works, but all demands can be more than met with the iron available, and in some instances quite large stores of metal have been run into store. For special iron there is a moderate demand. Charcoal iron finds a ready sale, but the output is extremely small from the one furnace at Backbarrow. Manganese iron is in fair call. Prices recently have been easing down, but this has not induced any additional business. Taking the whole of the district, there are thirteen furnaces in blast, against twenty-five to thirty in normal times.

Iron Ore.

There is a quieter demand for hematite iron ore, and the Hodbarrow Mining Company has found it necessary to close down its pits, some thousand men being affected. These are the richest mines in the district, and closing down was a process not known for many years. No Spanish ore was imported into Barrow last week, but fair stores of this ore are held at Barrow on the docks.

Steel.

There are no new features to report in the steel trade. At Barrow the Siemens departments, rail, merchant, hoop and section mills are engaged this week, together with the foundries, and at Workington the rail and axle and tire departments are at work. Business, however, is quiet in both finished and semi-finished steel. Next week the whole of the departments will be on holiday.

Shipbuilding and Engineering.

The continuance of the boilermakers' dispute is holding up work on the shipbuilding side of the Barrow yard, and a settlement appears to be as far away as ever. On the engineering side, there is a fair amount of activity in some departments.

Fuel.

For steam coal there is a quieter demand, and East Coast coke is in smaller consumption.

SHEFFIELD.

(From our own Correspondent.)

Trade in Sheffield.

TRADE in Sheffield may be said to have reached a point of stagnation. The future is so uncertain that neither in the raw or finished materials is any business of moment coming along. Lower prices of pig iron scrap and steel fail to bring buyers and sellers to the point of doing business beyond immediate needs. The fact, too, that many trades depended year after year very largely upon work in connection with armament manufacture is another very serious contributory cause to the general state of chaos in the industry of the city. Heavy losses are being sustained by the armament firms in keeping plant and machinery idle. The old light trades of the city have also very little to do. Orders are fewer now than for some time in the cutlery and plate lines, though toolmakers are reaping some benefit in the demand for garden and farm implements.

Proposed New Railway Station.

The Thurnscoe and Bolton-on-Dearne Urban Councils have made a joint representation to the railway companies with a view to securing a station on the Swinton and Knottingley line for the Thurnscoe and Goldthorpe districts. The only station at Thurnscoe is on the Hull and Barnsley Railway and Goldthorpe has only the Dearne Valley Railway halt. Officials of the London and North-Eastern Railway and the London, Midland and Scottish Railway have met the local authorities and have discussed the proposition with them.

Beating the Germans.

Manufacturers in Sheffield are just now making strenuous efforts to beat the Germans in their production of cheap table plate. At the moment they are meeting with a fair measure of success. One firm at least has produced a table plate at a price so low and of a quality so good that it is being kept constantly employed fulfilling orders for hundreds of gross. The plate made so cheaply includes table spoons and forks and tea spoons at 1s. 9d. per dozen. The tea spoons, it will be seen, work out at 1¼d. each, and samples prove them to be serviceable and well-finished articles. The prices quoted are wholesale. Apart from the success of the venture being caused by the use of a special type of basis metal, it is also helped by mass production on machinery made by a French company, and this machinery is the only set of its kind in this country.

Mining Research.

Professor Douglas Hay, Professor of Mining at the University of Sheffield, has issued an interesting report on the work of his department during the session 1922 to 1923. There were twelve students for the mining degree course. Of the six final students one obtained a degree with second-class honours, one a first-class ordinary and two second-class ordinary degrees. The standard demanded is kept high in view of the responsible nature of the work performed in after years. Eight of the final students for the mining diploma course were successful and two failed. Newton, Chambers and Co. have commenced to support the part-week course, in addition to John Brown and Co. and the Rothervale Company, and it is hoped that other collieries will take advantage of the facilities offered for the higher technical training of colliery under-officials. The report states that "In consequence of the creation of additional facilities at local centres, it is possible that in the near future insufficient students will present themselves to enable the Saturday afternoon classes to be continued. In this event it is hoped that local education authorities and other interested bodies will provide scholarships admitting to the full-time degree and diploma courses, so that a full university training is rendered possible to all ranks of the mining industry, as is done in other countries. The department is now authorised by the Secretary for Mines to conduct examinations for deputies and shot-firers. The first examination was held in March, when fifteen candidates presented themselves."

Researches into Flame Danger.

A large amount of research work has, the report continues, been done during the year. The research of flame-proofedness of electrical apparatus has supplied a long-felt need in the industry, and a large amount of testing has been undertaken for both collieries and for manufacturers. Researches are now being conducted on the possibility of ignition of fire-damp by frictional sparks. Research work has also been carried out on centrifugal fans and mine ventilation.

NORTH OF ENGLAND.

(From our own Correspondent.)

A Black Outlook.

THE all-round depression in trade in the North of England which has continued unbroken ever since Easter shows, as yet, no signs of lifting, and the seasonal holiday influences only serve to accentuate the prevailing dullness. In the iron and steel industries the position is

becoming increasingly serious. Most of the big contracts which were placed some months ago are nearly finished, and as there is scarcely any new buying, it is feared that manufacturers will have no other alternative than to close down their plant. In some departments operations are already being reduced. Some little hope of a change for the better is gathered, however, from reports that many continental manufacturers have secured as much work as they are capable of executing for some time, unless circumstances alter, and that, consequently, the usual autumn season demand may have to be met by British firms.

Cleveland Iron Trade.

There are practically no bright spots in the Cleveland pig iron trade. Indeed, the position is gradually growing worse, and business has tapered off to such an extent that it is to be feared that within the next week or two several furnaces will have to be damped down. The steady decline in values, so far from stimulating business, strengthens the determination of home consumers to keep out of the market, buying only odd truckloads to cover absolutely minimum needs. The export outlook continues to be discouraging from whatever quarter it is viewed. Continental purchasing power appears to be at a very low ebb. Scandinavia is doing next to nothing, and Belgium, which can produce iron more cheaply than Cleveland, is consequently in a better position to supply surrounding customers. Italy, with the lira at a big discount compared with sterling, is only buying British iron from hand to mouth, and is, in fact, where purchases from abroad have to be made, taking cheaper French material. The general position, therefore, is such that it is at most doubtful whether any further lowering of Cleveland values would at the moment serve to give any stimulus to the market. In any case, makers, at present prices, are producing at a loss, and with fuel costs even firmer than they were a week ago, there would appear to be little hope of further concessions. At all events, makers are adhering to 104s. for No. 3 G.M.B. Cleveland pig iron. No. 4 foundry stands at 100s., No. 4 forge at 97s. 6d., and No. 1, of which there are only very small quantities obtainable, at 115s.

Hematite Pig Iron.

The outlook in the East Coast hematite pig iron trade shows no improvement. Export inquiry is still weak, and during the last few days there have been no German buyers on the market, owing, no doubt, to the present altogether derisory position of the mark. The price of mixed numbers is held nominally at 100s., but this figure is reported to have been shaded for some fair-sized parcels. No. 1 is at a premium of 6d. to 1s. per ton.

Iron-making Materials.

The foreign ore position is lifeless and unchanged, with best Rubio quite nominal at round about 23s. per ton c.i.f. Tees. The fuel position is rather firmer, and sellers are now holding out for fully 42s. 6d. per ton for good medium furnace coke delivered at the works.

Manufactured Iron and Steel.

In one or two branches of the manufactured iron and steel trade more inquiry is circulating, but actual business matures only slowly, and several manufacturers are running short of work. Quotations are unchanged.

The Coal Trade.

The Northern coal trade position seems to be gradually weakening from day to day. All the life and vim appear to have gone out of the market. The whole situation is turning in favour of the buyers, who at present are in a favourable position for bargaining, and are able at almost any time to discount quoted prices, either direct or through merchants. The chief factor in the deteriorating process is undoubtedly the falling away of continental orders, which just now are remarkably scarce and backward. The latest information from Belgium and Germany is to the effect that large stocks are in hand there, so that instead of new business coming forward, there are more often requests for postponement of delivery, or, alternatively, cancellation of orders. The other usual continental outlets are also very slow in launching new inquiries, so that quite a lull in the trade is now being experienced. Whether it will last any time, or is just a passing phase, remains to be seen, but the appearances at present all seem to suggest a gradual easing off and a falling market for some time to come. The colliery positions are only barely satisfactory at the best. In some instances they have been laid idle for a few days at a time through the falling back of vessels booked to be loaded. The settlement of the dockers' strike at Hull and the apparently approaching general resumption in London, which would end the trouble, is, however, expected to release considerable tonnage and benefit the Northern coal trade, enabling the output to be completely cleared at remunerative prices. The Northumberland steam coal section is rather flat and dispirited, with nothing of note under discussion. Values tend to shrink, and though some producers maintain their quotations, they are only nominal indications, as in every case the coal fitters are inclined to give concessions when definite business is under discussion. The Durham gas coal market is generally weak and erratic. Best classes of gas and selected brands of coking are steady, but for any other class of gas, coking or bunkers there is not much business offering. The coke market is very firm for any make of foundry or gas coke.

SCOTLAND.

(From our own Correspondent.)

Holiday Markets.

Owing to the fact that many works were still on holiday, markets throughout the past week were almost devoid of movement. For the same reason there is no change so far in the industrial outlook, which at the moment is anything but bright.

Shipbuilding Slump.

The Clyde shipbuilding returns for July almost presented a record for non-production. The figures given are the second lowest so far known, the smallest known return having been in April of last year, when one vessel of 25 tons was launched. The totals for last month comprised only five small craft of 754 tons aggregate. The reason for this poor output is not far to seek. Almost all craft which could be brought to the launching stage without the ironworkers were put into the water before July. Consequently, until the lock-out is ended no improvement can be expected. New orders, naturally, are very scarce, as even though prices were conducive, there could be no guarantee of delivery under present conditions. About the only fresh contract worth mention was one for three vessels of 400ft. each, placed with Messrs. Harland and Wolff on behalf of Messrs. Andrew Weir and Co., Glasgow and London. For the seven months of this year the Clyde output totals sixty-three vessels of 146,411 tons aggregate, compared with seventy-three vessels of 200,454 tons for the same period last year.

No Improvement in Pig Iron.

The pig iron market has resumed, but nothing has transpired as yet to change the outlook, and prospects are depressing. Home demands are decidedly weak, despite frequent reductions in prices, while the export trade represents a very small turnover. It seems now almost imperative that outputs must be cut down.

Steel and Iron Uncertain.

Some of the steel and ironworks have a fair amount of work on hand, but these, as well as others, are bewailing the lack of fresh business. The labour trouble on the Clyde must certainly curtail orders to a certain extent, but it is questionable if much business could be done at present prices, even if the labour differences were settled. Before the lock-out consumers were purchasing most sparingly, and there was small hope of large purchases until prices showed a substantial drop. Orders for plates and sectional material could not be looked for in any great bulk, but sheet makers could have done better, especially on export account. Bar ironmakers, too, had begun to feel the competition from continental sources and have little hope of picking up the small lines on offer so long as their quotations remain at £12 per ton for "Crown" bars. Re-rolled steel is in much the same position, the chief demand being for tube strips only. Practically nothing is being done in scrap material at present.

Coal.

The coal trade is almost the only mainstay holding out promise of improvement. The market is only beginning to recover from the holidays, but already foreign buyers are sounding the market with regard to supplies of round coal. Considerable orders are in prospect if prices can be kept anywhere near the lowest recent quotations. The firmness of washed nuts and pearls is the feature of the market. These descriptions continue in good demand, and with supplies somewhat short no difficulty is experienced in securing full prices for shipment. Shipments for the week amounted to 267,359 tons, against 319,159 tons in the preceding week and 288,548 tons in the same week last year. The home market for coal is very dull.

Increased Coal Shipments.

The coal shipments for this year to date show an increase of 2,338,344 tons, compared with the same period last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

The conditions prevailing in the steam coal trade are very much on the lines of those in evidence before a holiday period, except that there is not quite the amount of loading pressure usually witnessed. Actual business is on a very limited scale. For one thing, collieries have practically no coals to offer for early shipment, owing to outputs being reduced and supplies being scarcely equal to their commitments, though at the same time it has to be admitted that the foreign inquiry for coals is almost negligible. This is not surprising when consideration is given to the uncertain financial conditions prevailing on the Continent. Most foreign buyers are holding off and awaiting developments, and, of course, it has to be remembered that the months of July and August are usually the quietest in the year in the absence of exceptional extraneous conditions, such as a miners' strike in America, as was the case last year, resulting in a substantial demand for coals from this country. The European demand is moderate in the extreme, and apart from one or two inquiries for 10,000 to 15,000 tons, one of which is for the Norte Railways of Spain, there is scarcely any activity worth speaking of. The majority of collieries appear, however, to be comfortably placed for business for practically the whole of the August, and despite the general quietness, prices are being well maintained.

Third Shift.

The position regarding the future working of the partial third shift at Welsh ports appears to be somewhat obscure. There was a meeting of the local committee appointed under the third-shift agreement to make suggestions and consider complaints on Saturday last at Cardiff, when it was agreed, in view of the reduced shipments and the consequent effect in reducing the men's wages, that as from August 13th the number of appliances to be worked on the third shift at Cardiff should be eight, at Barry nine, and at Penarth three, and it was arranged that the number of appliances working on the third shift should come up again for review at the next meeting of the local committee. This means that the tips now working at night in Cardiff and Barry will be reduced at each port by four and at Penarth by one. A number of tippers appear, however, to be dissatisfied, and an unofficial meeting of the men was held on Sunday at Cardiff to consider the question of giving seven days' notice to terminate the working of the third shift. The meeting decided they would not accept the arrangement come to on Saturday regarding the reduction in the number of appliances, and the general attitude to be adopted is to come up for further consideration later in the week. Meanwhile, it is reported that the Swansea tippers have decided to continue working the third shift and not to take any unofficial action, but to press for the cessation of the shift with the employers.

Steel and Tin-plate Trades.

It is very satisfactory to note that fears regarding trouble in the tin-plate trade on the question of wages and conditions have now vanished, and an agreement has been arrived at. The adjourned meeting of the Tin-plate Joint Industrial Council was held at Swansea on Monday last, when questions respecting the bundlers, annealers and assorters were referred to committees for investigation, as also were claims on behalf of the risers and pointers in reference to Player's tinning machine. A new claim was put forward that an inquiry should be made as to the capacity of the trade to meet the claims of the men but the employers pointed out that no new claim could be considered at an adjourned meeting. As regards the 3¼ per cent. increase on the last ascertainment under the sliding scale, the employers decided to continue their 7½ per cent. *ex-gratia* payment for another three months, and to give the men the additional advantage of this 3¼ per cent., making the total for the next quarter 11¼ per cent. As to the application of the men for holiday payment in August, the chairman—Mr. F. W. Gibbins—said that the employers were bound to decline it on the ground of expense. They had, however, had one or two schemes put before them which they were prepared to consider fully, and which might ease the position at some future date. The men accepted this intimation. The Joint Steel Board meeting at Swansea has also come to an agreement respecting the claims of the locomotive men and shunters in the industry. An advance has been granted the shunters of 20 per cent. and from 15 to 18 per cent. to the locomotive men, in addition to the 5 per cent. on the last steel price ascertainment. This agreement came into operation on Monday last, and will have the effect of fixing a uniform datal rate for these sections on a basis of 8s. for drivers and 7s. for shunters, but does not affect the tonnage bonuses which are in operation in some of the works.

Mechanical Workers.

In view of the fight which has been going on for months past between the South Wales Miners' Federation and the Mechanical Workers' Union, the position regarding the strength of the latter organisation as revealed at the half-yearly meeting held at Cardiff on Saturday last is interesting. The general secretary reported that the delegates present represented 8500 members and 5237 in full compliance. As compared with a year ago, there had been only a loss of 200 members. This was largely due to the fact that the union had adopted the policy not to organise classes of workmen outside the enginemen, stokers and craftsmen, and that during the past three months they had asked workmen who were not of the categories mentioned to terminate their membership. The position therefore was, he said, considered to be extremely satisfactory, especially in view of the intensive campaign that had been directed against the Mechanical Workers' Union. It was abundantly clear that whatever the Trade Union Congress might do in the matter of the affiliation of the union, enginemen, stokers and craftsmen in South Wales would continue to be organised in the future.

Current Business.

Although the current demand is extremely slow, the tone of the steam coal market is steady, especially for the superior grades. Some of the inferior grades are not in such a favourable position, but it is unlikely that there will be very much change in prices now ruling in view of the holiday and the curtailment of production that will be entailed. It has been decided that the miners shall have three days' holiday—that is, the first three days of next week—while so far as the docks are concerned, there will be no work in the shipment of coals during Monday and Tuesday of next week. There is a fair supply of tonnage in dock, and it is likely that for loading after the vacation supplies of coal will be scarce, more especially as many of the miners will refrain from work the whole of next week. At the moment, best Admiralty large are firmly quoted at 30s. to 31s., and second qualities range from 29s. to 30s. Monmouthshire of the better qualities are fairly steady at round about 29s. Smalls of the better classes command about 21s., but inferior sorts are more plentiful and range about 16s. to 18s. The inquiry for patent fuel is on the quiet side, but coke is firm at 55s. to 62s. 6d. Anthracite coals are scarcely quite as firm as a week ago, except in the case of sized qualities, which show no material change.

A concession for the generation and transmission to the port of Calicut, in India, of electric energy has been applied for by two members of the firm of Messrs. Alfred Dickinson and Co., in conjunction with Balfour, Beatty and Co., Limited, of London, and the General Electric Company, Limited. A licence has been asked for the sole right to collect and store the water of the catchment area of the Pykara River in the Nilgiris, and to utilise it for the development of electrical energy for general industrial purposes.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	26/-
(1) Spanish	24/-
(1) N. African	24/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	23/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	5 16 3	—
No. 1 Foundry	5 10 6	—
No. 3 Foundry	5 5 0	—
N.E. Coast—		
Hematite Mixed Nos.	5 0 0	5 0 0
No. 1	5 0 6	5 0 6
Cleveland—		
No. 1	5 15 0	5 15 0
Silicious Iron	5 10 0	5 10 0
No. 3 G.M.B.	5 4 0	5 4 0
No. 4 Foundry	5 0 0	5 0 0
No. 4 Forge	4 17 6	4 17 6
Mottled	—	—
White	—	—
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
North Staffs. Forge*	—	—
„ „ Foundry	5 0 0 to 5 2 6	
(3) Northampton—		
Foundry No. 3	4 15 0 to 4 16 0	
„ Forge	4 9 0	—
(3) Derbyshire—		
No. 3 Foundry	4 15 0 to 4 17 6	
Forge	4 10 0	—
(3) Lincolnshire—		
Basic	5 5 0	—
Foundry	5 0 0	—
Forge	4 15 0	—
(4) N.W. Coast—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	5 17 6†	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	12 0 0	—
Best „	—	—
N.E. Coast—		
Crown Bars	12 0 0	—
Tees	10 0 0	—
Lancs.—		
Crown Bars	12 0 0	—
Second Quality Bars	11 5 0	—
Hoops	15 0 0	14 15 0
S. Yorks.—		
Crown Bars	12 10 0	—
Best „	13 10 0	—
Hoops	15 10 0	—
Midlands—		
Crown Bars	12 0 0 to 12 10 0	
Marked Bars (Staffs.)	14 10 0	—
Nut and Bolt Bars	11 0 0 to 11 5 0	
Gas Tube Strip	12 10 0 to 13 0 0	

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	13 0 0	—
Ship Plates, ¼in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ¼in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 17 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	10 0 0	—
Angles	9 10 0	—
Boiler Plates	14 0 0	—
Joists	9 15 0	—
Heavy Rails	10 0 0	—
Fish-plates	14 0 0	—
Channels	9 5 0	—
Hard Billets	10 5 0	—
Soft Billets	9 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	9 10 0†	—
Light „	12 0 0†	—
Billets	11 0 0†	—
Manchester—		
Bars (Round)	11 0 0 to 11 5 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 5 0 to 10 10 0	
„ (Lancs. Boiler)	13 10 0	—
Sheffield—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	10 5 0	—
Intermediate Basic	10 0 0	—
Soft Basic	8 10 0	—
Hoops	12 15 0 to 13 5 0	
Soft Wire Rods	13 0 0	—
Midlands—		
Small Rolled Bars	9 15 0 to 10 0 0	
Billets and Sheet-bars	7 15 0 to 8 5 0	
Gas Tube Strip	11 0 0 to 11 10 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	18 5 0	—
Angles	9 15 0	—
Joists	9 15 0	—
Tees	10 15 0	—
Bridge and Tank Plates	10 5 0 to 10 10 0	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	23/1½
Block Tin (cash)	184 15 0
„ (three months)	185 10 0
Copper (cash)	95 5 0
„ (three months)	66 6 0
Spanish Lead (cash)	24 7 6
„ (three months)	24 10 0
Spelter (cash)	31 15 0
„ (three months)	31 10 0
Manchester—	
Copper, Best Selected Ingots	70 0 0
„ Electrolytic	73 0 0
„ Strong Sheets	100 0 0
„ Loco. Tubes	0 1 1½
Brass Loco. Tubes	0 1 0
„ Condenser	0 1 2½
Lead, English	25 15 0
„ Foreign	24 10 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/11 per lb.	
Ferro Tungsten	1/5½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	10/6
„ 6 p.c. to 8 p.c. „	£21 0 0	8/-
„ 8 p.c. to 10 p.c. „	£20 0 0	8/-
„ Specially Refined		
„ Max. 2 p.c. carbon	£50 0 0	18/-
„ „ 1 p.c. „	£60 0 0	21/-
„ „ 0.75 p.c. carbon	£70 0 0	22/6
„ carbon free	1/6 per lb.	
Metallic Chromium	4/6 per lb.	
Ferro Manganese (per ton)	£18 for home, £20 for export	
„ Silicon, 45 p.c. to 50 p.c.	£13 0 0 scale 5/- per unit	
„ „ 75 p.c.	£21 0 0 scale 6/- per unit	
„ Vanadium	16/9 per lb.	
„ Molybdenum	9/6 per lb.	
„ Titanium (carbon free)	1/1 per lb.	
Nickel (per ton)	£130	
Cobalt	12/- per lb.	
Aluminium (per ton)	£82 to £100 (British Official.)	

FUELS.

SCOTLAND.

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	21/-
„ „ Ell	22/-
„ „ Splint	25/ to 26/-
„ „ Trebles	26/-
„ „ Doubles	25/-
„ „ Singles	24/-
Ayrshire—	
(f.o.b. Ports)—Steam	21/-
„ „ Splint	25/-
„ „ Trebles	26/-
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	21/6 to 24/-
Screened Navigation	29/6
Trebles	26/6 to 27/-
Doubles	25/6
Singles	24/6
Lothians—	
(f.o.b. Leith)—Best Steam	22/6
Secondary Steam	21/-
Trebles	27/-
Doubles	25/6
Singles	24/6

ENGLAND.

	Export.
(8) N.W. Coast—	
Steams	31/6
Household	46/8 to 57/6
Coke	43/-
Northumberland—	
Best Steams	25/- to 26/-
Second Steams	23/ to 24/-
Steam Smalls	15/6 to 17/-
Unscreened	20/6
Household	25/- to 26/-
Durham—	
Best Gas	27/- to 28/-
Second	23/- to 25/-
Household	25/- to 28/-
Foundry Coke	60/- to 62/6

Sheffield	Inland.	
Best Hand-picked Branch	32/6 to 34/6	—
Barnsley Best Silkstone	26/6 to 28/-	—
Derbyshire Best Brights	25/- to 27/-	—
„ „ House	22/6 to 23/6	—
„ „ Large Nuts	20/- to 21/6	—
„ „ Small „	15/- to 18/-	—
Yorkshire Hards	21/- to 23/-	—
Derbyshire „	20/- to 22/-	—
Rough Slacks	11/6 to 13/6	—
Nutty „	10/- to 12/-	—
Smalls	7/- to 9/-	—
Blast-furnace Coke (Inland)	32/- to 33/-	
„ „ (Export)	f.o.b.	44/- to 45/-

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	30/- to 31/
Second „	28/- to 30/
Best Dry Large	28/6 to 29
Ordinary Dry Large	27/- to 28/-
Best Black Vein Large	28/6 to 29/6
Western Valley „	27/6 to 28/6
Best Eastern Valley Large	27/- to 28/-
Ordinary „ „	26/- to 27/-
Best Steam Smalls	21/- to 22/-
Ordinary „	19/- to 21/-
Washed Nuts	30/- to 32/6
No. 3 Rhondda Large	32/- to 33/-
„ „ Smalls	25/6 to 26/6
No. 2 „ Large	24/- to 25/-
„ „ Through	22/6 to 23/-
„ „ Smalls	16/- to 17/-
Coke (export)	55/- to 62,6
Patent Fuel	32/- to 34/-
Pitwood (ex ship)	32/6 to 33/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	50/- to 52,6
Seconds	42/6 to 45/-
Red Vein	30/- to 32,6
Machine-made Cobbles	62/6 to 65/-
Nuts	62/6 to 65/-
Beans	45/- to 47/6
Peas	25/- to 27/6
Breaker Duff	12/6 to 13/-
Rubbly Culm	15/- to 16/-
Steam Coals:	
Large	26/- to 27/6
Seconds	23/6 to 26/-
Smalls	18/- to 22/-
Cargo Through	22/6 to 25/-

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* Quotations extremely high and nominal. † Latest quotations available.

French Engineering Notes.

(*From our Correspondent in Paris.*)

Coke Supply.

The question of coke supplies is so vital to the iron and steel industries that it is impossible to get away from the feeling of nervousness which is observable everywhere over the trade future. So irregular are consignments from the Ruhr that blast-furnace proprietors believe that they have good ground for their apprehension that little is being done to ensure a continuance of supplies after an exhaustion of the stocks of coke. Official statements attribute the falling off in consignments to other causes than the clearing away of reserves, for it is affirmed that there are still 1,200,000 tons of coke and 2,000,000 tons of coal waiting to be loaded on to trucks. Nevertheless, it appears fairly certain that nothing has been done to ensure the working of the Ruhr ovens, in which event a famine in coke can only be staved off for a short period, though Monsieur Le Trocquer insists that everything is for the best, and that coke users will soon have tangible evidence of the activity and ingenuity of those who are endeavouring to exploit the Ruhr. Meanwhile, consumers prefer to see evidence of progress elsewhere, notably in the Saar, where the efforts to produce hard coke by new processes have at least given promising results, and at the French collieries where a large number of ovens are being constructed. At Lens, Aniche, Homecourt and elsewhere, new ovens are being put into operation, and it appears fairly certain that, with the improved methods of producing coke from what was previously considered to be unsuitable coal, blast-furnace proprietors will be assured in time of sufficient supplies at a reasonably low price; but it is equally obvious that for a long while to come the French iron industry will be in a very precarious situation, unless it can depend upon consignments from the Ruhr.

Electrification.

The scheme of national electrification is being carried out so actively that in a few years time there is every prospect of electrical energy being distributed over the greater part of the country, with a continuous system of high-tension feeders from Lille to the Pyrenees. The French are convinced that the scheme will provide them with a convenient and cheap form of power, and will permit of their realising a considerable economy in foreign coal. As to the cheapness, everything naturally depends upon the consumption, which must bring down the price to a level that will encourage the general use of current, but while it was claimed that the national scheme would cut the price by one-half, there is unfortunately no evidence yet of a reduction, despite the considerable amount of energy now available for distribution. There are close upon 9000 kiloms. of feeders constructed or under construction for potentials of from 45,000 to 90,000 volts, and even up to 120,000 and 150,000 volts. In the Dauphiné, the Massif Central and the Pyrenees, powerful hydro-electric plants have been installed, while in the North and the East the alternators are driven by heat engines. The distributing arrangements have been completed in nine principal districts, and the work of connecting them up in a national system has been started upon, so that the northern, central and southern systems will be able to depend upon each other and regulate the distribution in each district. Thus the country will be supplied with energy independently of what will be furnished by the Rhone scheme, which is apparently being held up on account of the difficulty of conciliating financial interests. Meanwhile, numerous concessions are being accorded to companies for the laying down of hydro-electric installations, and so much is being done in this direction that the electrical engineering industry is particularly active in all its branches.

Electric Traction.

In view of the remarkable development of electrical enterprise, efforts are being made to widen the field for the consumption of current, and a company has just been formed by practically all the electricity companies in the Paris district to encourage the use of electric road vehicles. As one of the promoters is the managing director of the Transports en Commun, it may be assumed that the problem is awakening some interest in view of a possible application to public transport vehicles. The use of electricity for road traction is intended to offer one solution of the problem of limiting the consumption of petrol, which it is hoped to reserve largely for aviation and for other purposes more directly interesting national defence.

Air Resistance.

The Committee of Scientific Research and Invention is carrying out a good deal of interesting work at the Meudon Laboratory, as is shown by the communications made from time to time at the Academy of Science by M. J. L. Breton, who last week gave results of some tests with a model, to measure the resistance of air to trains running at various speeds. According to M. Breton, an ordinary train with ten coaches absorbs 440 horse-power at 56 miles an hour and 760 horse-power at 67 miles an hour—both on the level. He showed that considerable economies could be effected by modifying the form of the trains.

Naval Manœuvres.

One of the themes of the naval manœuvres, which concluded recently, was an attempted landing by a hostile fleet on the Channel coast in the face of a strong air and submarine defence. The idea was to demonstrate whether aeroplanes and submarines could be relied upon for protection. The "enemy," coming into the Channel from the Atlantic, was able to profit from a fog to land troops, and the conclusion therefore come to is that land batteries cannot be dispensed with on the Channel and North Sea coasts where fogs are more or less prevalent.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

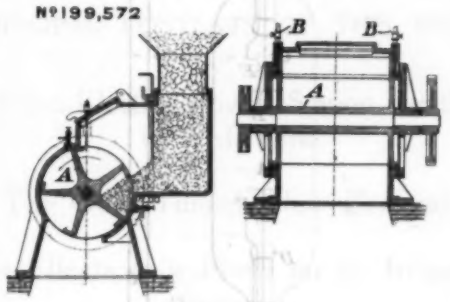
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

GAS PRODUCERS.

199,572. May 23rd, 1922.—Fuel Hoppers, *J. Y. Johnson, 47, Lincoln's Inn-fields, London.*

In order to seal the fuel hopper of a gas producer against the loss of gas, without undue friction, the inventor makes the drum

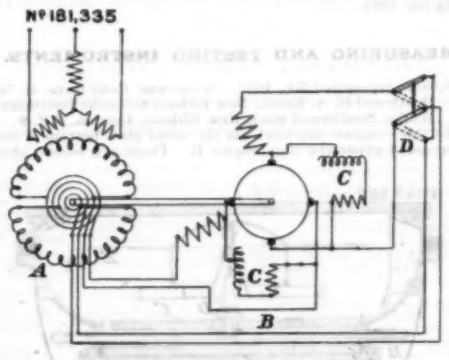


A an easy fit in its casing, suggesting a clearance of 1/16in., and supplies the intervening space with water through the connections B B. The edges of the drum are grooved to retain the water.—*June 28th*, 1923.

DYNAMOS AND MOTORS.

181,335. May 4th, 1922.—Improvements in Alternating-current Motor Groups, Forges et Ateliers de Constructions Electriques de Jeumont, of 75, Boulevard Haussman, Paris.

An asynchronous motor A is connected in cascade with a polyphase commutator motor B having variable inductances C shunted across its brushes as shown. The regulation of speed

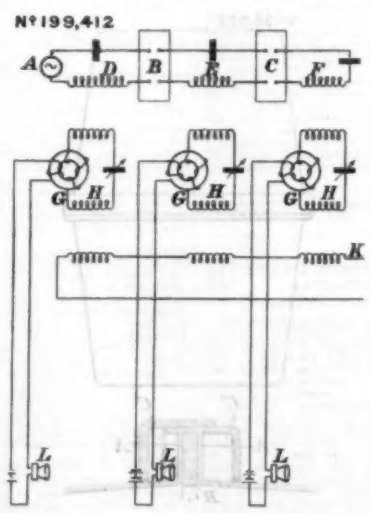


when the machine is running below synchronism is obtained by varying the inductances. The switch D changes the relative direction of the revolving rotor fields of the main machine and in the commutating machine, so that the main machine may run at speeds above synchronism.—*June 28th*, 1923.

TELEGRAPHS AND TELEPHONES.

199,412. December 22nd, 1921.—Method for Multiple High-frequency Telephony and Telegraphy on Wires, *Herbert Sefton-Jones, of the firm of Sefton-Jones, O'Dell and Stephens, 285, High Holborn, London, W.C.* 1.

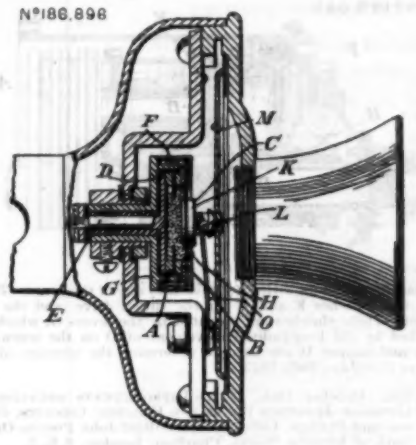
According to this invention generating systems are used to supply several frequencies simultaneously for multiple telegraphy or telephony. In the drawing, A indicates the high-



frequency machine with static frequency changers B and C. Currents of different frequency are taken from the coupling coils D E F. The currents are transmitted over tuned intermediate circuits to the line K. In the intermediate circuits there are placed, for instance, iron-cored coils G, which are influenced by the microphones L. H indicates the coupling coil for the transmission of the high-frequency currents to the line. Instead of the machine shown, any other high-frequency generator may be employed.—*June 22nd*, 1923.

186,896. July 6th, 1922.—Improvements in Telephone Transmitters, *Western Electric Company, Limited, Norfolk House, Victoria Embankment, Westminster, London, W.C.* 2.

The two most serious defects in transmitters of the granular carbon type are their susceptibility to burning and packing. An object of this invention is to provide a transmitter structure in which burning is not present to any noticeable degree. Another object is to provide a structure in which packing is absent or so small as not to interfere with the sensitivity of the instrument. Annular electrodes A and B are mounted on the walls of the chamber and insulated therefrom. Separating the electrodes is a washer-shaped barrier C of insulating material having a central opening through which the current between the electrodes

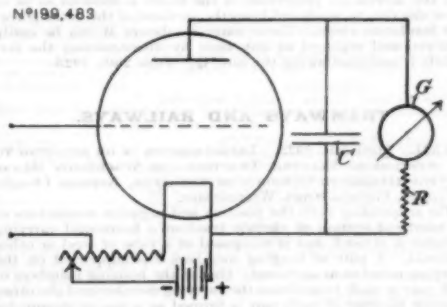


must pass. In the back of the chamber and insulated therefrom is a plate D, to which a rod E forming one electrode terminal is attached. The face of this plate is coated with insulating material except near the edge where it makes contact with the electrode A. A clamping ring F threaded to the cup G secures the electrodes and barrier in place. A flexible cover diaphragm H is secured by a similar ring. Supported in the centre of the closure is a plunger K which is provided with a stud L, by means of which vibrations of the main diaphragm M are transmitted to the diaphragm H. The plunger is held against the diaphragm M by the spring O. This construction permits no relative movement between the comminuted material and the electrodes.—*June 28th*, 1923.

ELECTRICAL APPLIANCES.

199,483. March 28th, 1922.—Improvements in the Measurement of Alternating Potential Differences, Eric Balliol Moullin, of Fairview, Shaftesbury-road, Cambridge.

This invention briefly consists in a method and means for measuring alternating voltages, wherein a three-electrode valve having asymmetric conductivity between anode and filament is employed. When an alternating E.M.F. is applied between the grid and filament the asymmetric conductivity causes an increase in the mean value of the anode current. The increase

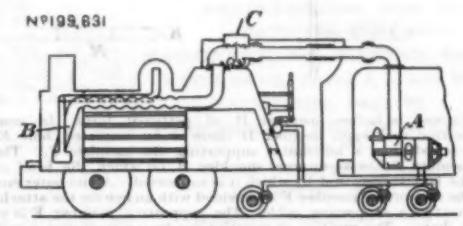


is taken as a measure of the alternating E.M.F applied to the valve and is measured on a galvanometer G connected between the anode and the positive side of the filament and calibrated to read the applied alternating E.M.F. directly. The invention also consists in various improved or simplified features. R is a high resistance connected to the positive of the filament battery, and C is a condenser of about 1 microfarad capacity.—*June 25th*, 1923.

LOCOMOTIVES.

199,631. August 2nd, 1922.—Turbo-electric Locomotives, Metropolitan-Vickers Electrical Company, Limited, 4, Central-buildings, Westminster.

This invention relates to the locomotives in which steam exhausted from the cylinders is further expanded in a low-pressure turbine which drives an electric generator. Its object



is to provide for the automatic maintenance of a substantially constant supply of steam to the low-pressure turbine under all conditions of operation and to the attainment of this end consists in the provision of means responsive to pressure within the

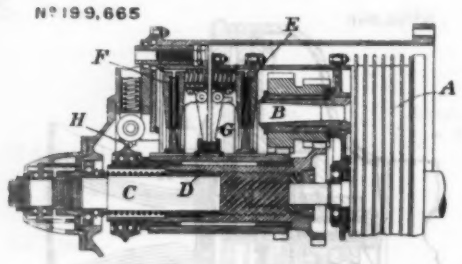
steam line between the cylinders and the low-pressure engine or turbine for delivering live steam to the latter. In the illustration the low-pressure turbine is shown at A and derives its steam from the exhaust B of the cylinders. The valve for providing high-pressure steam to the turbine, when necessary, is shown at C, and incidentally acts as a reducing valve, so that the turbine is always furnished with an appropriate supply of steam.—*June 28th*, 1923.

TRANSMISSION OF POWER.

199,665. November 1st, 1922.—Change-speed Gear, L. Renault, 15, Rue Gustave Sandox, Billancourt, France.

The inventor claims that this gear suppresses "the operation of clutching and of change speed." On the engine shaft there is a centrifugally operated automatic clutch A, on which there is mounted a planetary gear B. The driven shaft C has a screw

N° 199,665

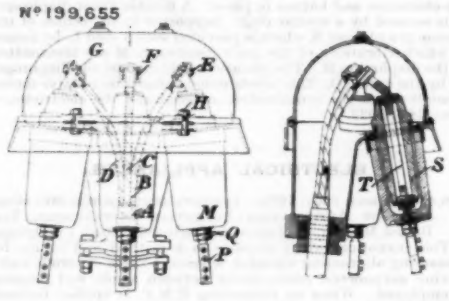


thread for engaging with the sleeve D of one of the gears. There are two clutches E and F for the direct drive and the low speed. These clutches are operated by the levers G, which are worked by the longitudinal movement of D on the screw. A cam and tappet H are used to determine the position of the sleeve D.—*June 28th*, 1923.

199,655. October 13th, 1922.—Improvements relating to Outdoor Junction Boxes for Electric Circuits, Johnson and Phillips, Limited, and Wilfrid John Previte Orton, both of Victoria Works, Charlton, London, S.E. 7.

The main conductor A, consisting of the branch conductors B C D, is supported by the cast metal box, the main conductor A passing through a gland inserted in a tubular extension of the box. The conductors are inserted in clamps E F G integral with bolts T in porcelain insulators S of tubular form. The

N° 199,655



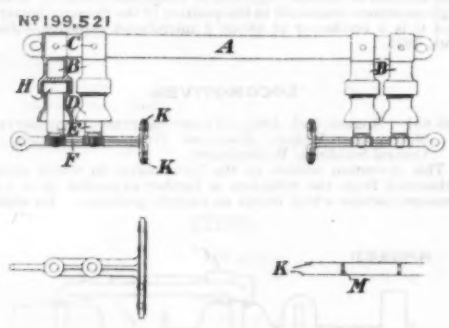
upper portion of the box is bolted to the lower portion by bolts H and the downward projection of the latter is reduced so as to allow the rain to wash and keep the surfaces of the outer porcelain insulators clean. These outer insulators M can be easily removed and replaced at any time by disconnecting the terminals P and unscrewing the nuts Q.—*June 20th*, 1923.

TRAMWAYS AND RAILWAYS.

199,521. April 5th, 1922.—Improvements in or relating to Systems of Electric Traction and Suspension Means for Overhead Conductors therefor, Norman Clough, of 36, Victoria-street, Westminster.

For suspending both the positive and negative conductors of an overhead system of electric traction a horizontal carrying member A is used, and is composed of a tube of steel or other material. A pair of hanging members B is supported on the carrying member at each end. One of the hanging members of each pair is made to embrace the carrying member and the other hanging member of each pair is formed as a cap or closure for an end of the horizontal carrying member A. The hanging members B are secured to the horizontal carrying member by pins C. The secondly mentioned hanging members of each pair are each formed with an eye for the attachment of the supporting cables. Each hanging member B is hollow, and into its lower end is

N° 199,521



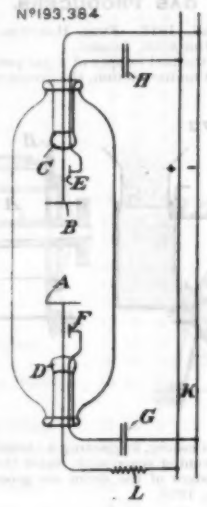
screwed a hollow member D of petticoat form. In connection with each member D there is an insulated bolt E, screwed into a horizontal supporting the member F. The member D has an internal shoulder H, on which the head of the bolt E rests and by which it is supported. At its outer end the supporting member F is provided with an eye for the attachment of a supporting cable. The supporting member F is of T shape. The positive or negative conductor comprises a pair of members K disposed one above the other and each connected together at intervals by the suspension devices, and between the suspension devices by connectors or suspenders M. By these latter means the members of a conductor are maintained parallel, or substantially parallel, for the whole of the distance between consecutive suspension devices.—*June 28th*, 1923.

LIGHTING AND HEATING.

193,384. July 5th, 1923.—Improvements in or relating to Gas-filled Discharge Tubes, Naamlooze Vennootschap Philips' Glosilampenfabrieken, Eindhoven, Holland.

This specification describes an improved arrangement for reducing the starting voltage of discharge tubes with a gaseous filling and for use with continuous current, and the invention relates more particularly to tubes containing a rare gas in which a discharge between main and auxiliary electrodes is initiated by an auxiliary discharge between an auxiliary electrode and one of the main electrodes. By applying such an auxiliary dis-

N°193,384



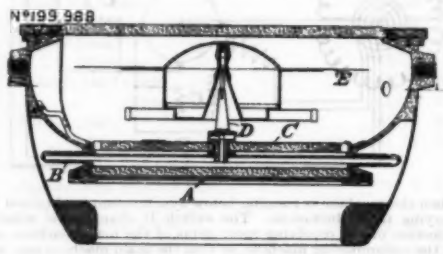
charge, the starting voltage of the main discharge is reduced, and the object of this invention is to further reduce this voltage and to improve the efficiency of the tube. The main electrodes A and B are supported by the leading-in wires, which are fused into the stems C and D. The auxiliary electrodes E and F are likewise supported by the leading-in wires, and are connected *via* the condensers G and H to the conductors K, to which the main electrodes are also connected. The conductors K are connected to a lighting circuit of suitable voltage. A stabilising resistance L is connected in series to the main electrodes.—*July 5th*, 1923.

MEASURING AND TESTING INSTRUMENTS.

199,988. September 5th, 1922.—Mariners' Compasses, G. W. Heath and G. A. Heath, New Eltham Scientific Instrument Works, Southwood-road, New Eltham, London, S.E. 9.

In this compass the bowl has the usual glass bottom A and corrugated expansion diaphragms B. There is a second glass

N°199,988



bottom C, above the diaphragms, and on this the pivot D of the card E is carried. Holes drilled through the pivot provide communication between the float chamber and the expansion chamber.—*July 5th*, 1923.

MISCELLANEOUS.

199,276. July 19th, 1922.—Metal Barrels, S. W. Challen, 62, Constitution-hill, Birmingham.

The inventor proposes to make metal barrels of two seamless

N°199,276

halves, pressed from sheet, flange over the edges at A and fix them together with a ring of jointing material B. The two halves are connected by the rings C C, which are slightly tapered and are driven one on to the other.—*June 21st*, 1923.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

SATURDAY, AUGUST 4TH.

North of England Institute of Mining and Mechanical Engineers.—Newcastle-upon-Tyne. Annual general meeting. 2 p.m.

WEDNESDAY, AUGUST 15TH.

Institution of Municipal and County Engineers.—Institution of Civil Engineers' Library, 35, Dawson-street, Dublin. Irish District meeting. 2.30 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

G. W. Brown, A.M.I. Mech. E., works manager of Musgrave and Co., Limited, St. Ann's Ironworks, Belfast, asks us to announce that he is resigning that position to take up several agencies.

Mr. Alec Ogilvie, C.B.E., F.R. Ae. S., has been elected chairman of the Royal Aeronautical Society for the year 1923-1924, in succession to Professor Leonard Bairstow, C.B.E., F.R.S., F.R. Ae. S., whose term of office expires on October 1st.

CONTRACTS.

The Hamworthy Engineering Company, Limited, has just received from H.M. Office of Works an order for two compressors, driven by 25 brake horse-power motors, for the House of Commons.

The Paterson Engineering Company, Limited, has received a contract for a water filtration plant of four million gallons capacity for the South Staffordshire Water Company's Lichfield works. The plant will include chemical treatment gear, sedimentation tanks, filters of the Paterson rapid gravity type, chlorine gas apparatus and effluent disposal plant.

The English Electric Company, Limited, has received from the Consett Iron Company the order for the electrical equipment in connection with that company's new main mill drives. The mills to be electrified are a 40in. slabbing mill and a 42in. plate mill, both of which will be driven by reversing motors with peak powers of 14,000 horse-power, running at 50–100 revolutions; a 32in. light plate mill, which will be of the three-high type, driven by a 2500 horse-power three-phase induction motor running at 240 revolutions per minute; and a chequer plate mill, which will be driven by a 750 horse-power induction motor running at 240 revolutions per minute.

LAUNCHES AND TRIAL TRIPS.

Romsey, screw passenger tender; reconstructed by Harland and Wolff, Limited, Govan, to the order of the Alexandra Towing Company, Limited; dimensions, 163ft. by 34ft. moulded by 18ft. 6in. depth moulded; gross tonnage, 890; capable of carrying over 1000 passengers. Engines, triple-expansion; boilers fitted for oil fuel; trial trip, July 13th.

San Quirino, oil tank steamer; built by Sir W. G. Armstrong, Whitworth and Co., Limited, to the order of the Eagle Oil Transport Company, Limited; dimensions, 407ft. by 52ft. by 31ft. 4in.; 8250 tons deadweight. Engines, triple-expansion; constructed by the Wallsend Slipway and Engineering Company, Limited; trial trip, July 18th.

City of Athens, steamer; built by Wm. Gray and Co., Limited, to the order of Ellerman Lines, Limited; dimensions, 450ft. 9in. by 57ft. 5in. by 32ft. 10in.; 10,600 tons deadweight. Engines, triple-expansion, 26in., 45in. and 78in. by 54in. stroke, pressure 230 lb.; constructed by the builders; trial trip, July 20th.

T.I.C. No. 21, hopper barge; built by Palmer's Shipbuilding and Iron Company, Limited, to the order of the Tyne Improvement Commission; dimensions, 175ft. by 32ft. 2in. by 14ft. 6in.; to carry 800 tons. Engines, direct-acting surface condensing triple-expansion, pressure 160 lb.; constructed by the Shields Engineering Company; handed to owners, July 23th.

Knaresbro, steamer; built by William Gray and Co., Limited, to the order of the Ellerman Lines, Limited; dimensions, 465ft. by 57ft. 9in. by 34ft. 8in.; 7343 gross tonnage. Engines, triple-expansion, 26in., 45in. and 78in. by 54in. stroke, pressure 230 lb.; constructed by the builders; launch, July 27th.

EDUCATIONAL INTELLIGENCE.

Mr. B. Kelly, member of the Iron and Steel Institute, will conduct a course of lectures on iron and steel at the City of London College, White-street, Moorfields, E.C. 2, arranged specially for the needs of men in export houses. The course will begin on September 25th, 1923.

A Goldsmid Scholarship, tenable in the Faculty of Engineering at University College, London, of the value of £90 (£30 a year for three years, subject to satisfactory progress), will be offered for competition at an examination to be held at the College in September. Particulars may be obtained on application to the Secretary of the College.

The Standardisation of Fans.—In common with other branches of engineering, the necessity for standardising the terms used in stating the performance or capacity of fans, and also a standard method of testing fans, has been apparent for some time—both to the users and to the makers. The Council of the Institution of Heating and Ventilating Engineers some time ago appointed a committee, known as the Fan Standardisation Committee, having representatives of both fan manufacturers and users, together with representatives from the Admiralty and H.M. Office of Works. This Committee has been holding meetings at regular intervals since the spring of last year. It finds that there are many difficult problems to settle, and that very considerable differences of opinion exist, both amongst the fan makers and also amongst the users, as to the correct terms to use and as to the best method of testing fans. It hopes, however, eventually to clear up all misunderstandings and ambiguities, and to issue a standard list of terms, also to define a standard method of fan testing and a clear method of listing fan performances.